ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 30. No. 18. WEEKLY. | NEW YORK, WEDNESDAY, MAY 5, 1897. | $3 PER ANNUM. Single Copies, 10 Cents.

Copyright, 1897, by ELECTRICAL REVIEW PUBLISHING COMPANY, Times Building, 41 Park Row, New York. Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

City Works Commissioner Willis, of Brooklyn, N. Y., has sent to the Board of Aldermen the bids received by him for lighting the streets and public buildings with electric light from January 1 to December 31, 1897. The bids were from the Edison, the Citizens' and the Municipal companies. The bids of all are the same as last year; namely, 34 cents per night per light of 1,200-candle-power, and various prices for incandescent lights. The Edison make the proposition that when four-hundred 1,200-candle-power lights, additional to the number furnished on December 31, 1896, shall be ordered and lighted, the price be then reduced one cent per 1,200 candle-power light, and that for all additional lights of 600 candle-power the price shall be increased from 18 to 20 cents per night per light. Also, if the number of lights be reduced below the number furnished on December 31 last, then the price shall be 40 cents for each 1,200-candle-power light per night, and 20 cents for each 600-candle-power light. The Citizens' made similar propositions with regard to increase or decrease in the number of lights, and the Municipal also, with the exception that they will reduce one cent when 200 additional lights are ordered. The bids were referred to the Committee on Electricity and Gas.

In the Criminal Court, at Louisville, Ky., on April 28, Judge Noble overruled a motion to dismiss the case of a saloon keeper who had tapped an electric light wire, and who maintained that he had taken nothing of value. Judge Noble decided that electricity is property, and the case will be tried on its merits.

Denver, Colo., paid for street lighting last year nearly $100,000. Some of the newspapers think this was too much, and it is expected that the matter will be investigated.

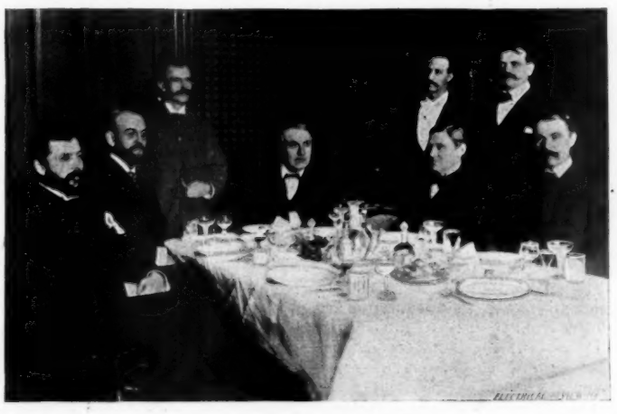
During the Grant parade in New York city the *Evening Sun* secured rapid news bulletins over a telephone line connected with the reviewing stand. At the downtown end of the line, seven miles away, the music of the bands, as they passed in review, could be heard distinctly.

One Corbett, who acquired the little end of a recent argument with one Fitzsimmons, has deemed it necessary to his happiness to sue Mr. Thomas A. Edison in a court of law. An injunction has been asked from the United States Circuit Court, at Trenton, N. J., to restrain Mr. Edison from manufacturing and selling photographic films of the Corbett–Courtney sparring match. The bill alleges that Corbett was induced to spar with Courtney before a camera by the Kinetoscope Exhibition Company, a New York corporation. The sparring exhibition was given under a contract with that company, which provided that Corbett and Brady, his manager, should be the sole and absolute owners of the films. Without any legal authority, they say, Mr. Edison has been making and selling the photographs in large quantities and realizing enormous profits. The suit will be heard by Judge Shiras.

Two new telephone cables, each with two circuits, are to be laid at once across the English Channel, making practically six lines for the London – Paris telephone service. They will raise to 34 the number of wires stretched across the channel from Dover to Beachy Head.

A prominent Boston gentleman is quoted as saying: "I never realized to what extent the telephone was a factor in the railroad and hotel business of the country until recently on a trip to St. Louis. While there, business matters in Boston required my immediate attention, but by the long-distance telephone I transacted my business within 10 minutes and saved a trip to Boston and back to St. Louis with attendant railroad fares and traveling expenses. This is probably but one instance where the telephone has saved railroad trips, and it bears out a statement made to me recently by a prominent railroad man, that the long-distance telephone has been considerable of a factor in decreasing passenger transportation earnings."

The American Bell Telephone Company will receive a premium of over $2,696,100 from the sale of its recently authorized issue of 23,650 shares of stock at the commissioner of corporation's price of $214 per share. Last year the company offered stockholders 21,500 shares at the commissioner's price of $200 per share. All but 4,255 shares were taken by the stockholders, these shares later bringing 203½ by auction.



THE LATEST PHOTOGRAPH OF THOMAS A. EDISON, MADE IN ALLENTOWN, PA.

Mr. Edison's Latest Photograph.

The accompanying illustration is from a photograph of Thomas A. Edison, taken while at dinner with some friends during a recent visit to Allentown, Pa. Mr. Edison was in Catasauqua, Pa., on business connected with his process for the recovery of low-grade iron ores, a matter which has occupied the most of his time and attention for several years past.

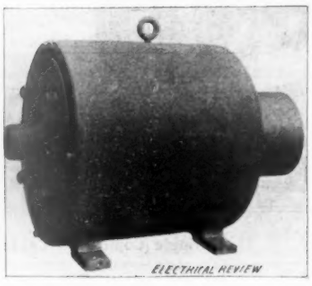
While in Catasauqua Mr. Edison visited the iron working establishments in the place, and expressed himself as pleased with the progress his own process was making. He visited the high-school, where he was welcomed by Professor Bevan and the scholars. Mr. Edison declined a request to make a speech. At the invitation of Col. John H. Harris, Mr. Edison dined with him and a party of friends at Allentown, where the accompanying picture was made. Those present, besides Mr. Edison and host were L. Peckitt, superintendent of the Crane Iron Company; W. S. Mallory, vice-president New Jersey & Pennsylvania Concentrating Company; W. S. Pilling, of Pilling & Crane; Edwin Thomas, president Phœnix Manufacturing Company, of Thomas, Ala.; Ben J. Frankenthal, Jr., president Thomas Iron Company; C. W. Master and E. G. Malson, all of whose portraits appear in the photograph.

Death of T. C. Price.

We regret to announce the death by typhus, on March 31, of Mr. T. C. Price, late manager of the Electrical Supply Company, of the city of Mexico. Mr. Price, although a comparatively new man in the field, had already won a host of friends in Mexico. His position as manager of the Electrical Supply Company has been filled by the appointment of Mr. Joseph Ketchum, of New York. Mr. Ketchum has been in the field as an engineer, manufacturer and dealer for the past 20 years, and the sound business methods practiced by Mr. Price in the conduct of the business will doubtless be ably continued by Mr. Ketchum.

The C & C Ironclad Motor.

In the accompanying illustration is shown a new type of C & C ironclad motor, manufactured by the C & C Electric Company, of New York city. The machine has four poles and magnet coils, and the coils may be readily removed after taking out the armature. They are also interchangeable. The armature is of the drum type,



C & C Ironclad Motor.

built up of thin laminæ of soft iron. The brush-holders are of the well known reaction type, and the bearings are self-oiling, with oil wells of large capacity.

The cylindrical form of this machine adapts it to all cases of direct connection, either through gears or otherwise. The gear shaft-boxes can be placed on the shell at any convenient position, as the distance from the shaft to the outside of the shell is always the same. The machine may also be run as a ceiling motor or attached at any angle to an A frame. The circular form of the end plates allows them to be bolted on, with the oil wells always in the proper position.

The ironclad magnetic field is ideal in its compactness, its circuits of minimum length, and its freedom from magnetic leakage. All of these qualities effect a saving in magnetizing force, and consequently afford a gain in efficiency. In this motor none of the moving parts, except the pulley, pinion or coupling, is outside of the shell, which secures safety not only to the operator, but also to the armature of the machine. It is claimed that no part of the armature conductors, field conductors, brushes or commutator will show a heat of more than 50 degrees Centigrade above the surrounding atmosphere. The efficiency is said to be from 85 to 92 per cent, depending on the size of the motor. The makers claim for this machine an exceedingly wide range of application with a high efficiency under all conditions.

LITERARY.

Ian Maclaren contributes to the May number of the *North American Review* a most attractive paper entitled simply "Henry Drummond". As the fellow student of Professor Drummond at Edinburgh University, and a life-long friend, these memoirs of one of the most brilliant men of our day, from the pen of the author of "Beside the Bonnie Brier Bush," are invested with a charm and value peculiarly and unapproachably their own.

Mr. J. B. Bennett, business manager of the *Street Railway Journal*, New York, spent last week in Chicago, where for several years he so ably represented that paper as western manager.

The Cashier's Electric Safety Cabinet.

The accompanying illustrations show the cashier's electric safety cabinet, a recently patented device manufactured by the Cashier's Electric Safety Cabinet Company, of Cleveland, Ohio. It is claimed to be the first device of its kind.

The operation of this machine is both mechanical and electrical—mechanical during the routine of business, electrical when a raid is made by robbers upon the bank or business house. With this cabinet in use, the funds, which have hitherto been placed in drawers and on top of counters, offering a tempting bait for robbers and sneak thieves, will be all placed inside the cash receptacle, which receptacle is always locked by the service mechanism, save when the cashier desires entrance into the receptacle in the ordinary course of business. By a quick and very convenient manipulation by the foot, the cabinet opens and remains open just so long as the cashier requires it; and at the instant it no longer needs to remain open, the cabinet, of its own volition, automatically closes and locks by the day locker, and remains locked until necessary to open again.

In the event of a raid, notwithstanding the fact that the cabinet is locked by the service mechanism, to place

Fig. 1.—The Cashier's Electric Safety Cabinet, Closed.

Fig. 2.—The Cashier's Electric Safety Cabinet, Open.

the cabinet and its contents absolutely beyond all power to open, wires are stretched from the base of the cabinet to all points of the bank or business house, with push-buttons at every desk in the bank, and all along the inside of the counters of business houses. When the rush is made by the raiders, any employé, by moving a foot a few inches and touching the push-button, causes the electric current to instantly operate the emergency mechanism, which locks the machine absolutely. It is then impossible for the burglar to open the machine; neither can he compel any one else to open it, for it can not be opened until an instrumentality, remote from the bank or business house, is applied. At the instant of the emergency-locking, in case of a raid, the electric attachment also disengages powerful machinery, and sets in motion a large gong, the roar of which can be heard a great distance, calling help from every direction.

Mr. P. F. King, the well known inventor of the famous screw-door bank safes, that have never been opened by burglars, is the inventor of this cabinet. The machine is made in three sizes, weighing from 400 to 700 pounds; sold at a price within the reach of all, and is built by the Cashier's Electric Safety Cabinet Company, of Cleveland, Ohio.

WESTERN NEWS NOTES.

W. H. McKinlock, president of the Metropolitan Electric Company, Chicago, returned last week from a very successful business trip through the West.

Mr. J. E. Way, representing the well known firm of R. Thomas & Sons, East Liverpool, Ohio, devoted several days recently to calling on the firm's numerous friends and customers in Chicago.

Farr Telephone and Construction Supply Company, Chicago, has in press a new and enlarged edition of its catalogue, which promises to eclipse anything of the kind previously issued. In addition to a complete line of telephone apparatus of different styles, the book will contain a list with prices of general telephone supplies, both for the manufacturer and user. The company has recently enlarged its manufacturing facilities, with a view of being better able to promptly supply the growing demand for its products in this particular line.

Mr. S. F. B. Morse, Chicago, who resigned on the 1st instant as western agent for the Kerite products, is fast completing arrangements for the handling of a very extensive line of light, power and railway specialties, used in either construction, operation or maintenance of stations or isolated plants. Mr. Morse has already secured the agency for the well known Medbury overhead materials, as well as for some reliable products in the way of arc and incandescent lamps, insulators, wires, etc., and will undoubtedly continue to meet with the uniform success he so readily secured in the past.

Mr. Alex. Churchward, electrical engineer of the Excelsior Electrical Company, is again making an extended trip through the West, in the interest of some power transmission work of which his company has been making quite a specialty of late. Mr. Churchward reports the state of business as being remarkably good so far as Excelsior apparatus is concerned, the company being compelled of late to operate its factory night and day in order to complete existing contracts on time. Mr. R. J. Randolph, the company's Chicago representative, has recently placed quite a number of the new Excelsior multipolar generators in that city for light and power purposes, and has received some strong expressions of commendation from their users.

The Electric Appliance Company, Chicago, evidently believes in always keeping in stock, ready for any sized order, a sufficient supply of such appliances as experience has proved to be reliable and dependable by consumers. This, President Low assured a representative of the Electrical Review the other day, is especially true of the porcelain goods handled by this company, and of which it probably carries the largest stock in the West. A visit to the company's premises showed one entire floor stocked with porcelain knobs, insulators, cleats, window-tubes and other porcelain fittings in almost endless variety, "reducing the chances," as President Low expressed himself, of "being just out" of a particular item called for to zero.

"The tendency of man to indulge his indolent inclinations is undoubtedly responsible for the invention and general use of the electric fan motor," says the Central Electric Company in its 1897 brochure on fan motors and ventilating apparatus, just from the press. The pamphlet is not only a very attractive specimen of the printers' art, but also sets forth in a most convincing manner the many meritorious points of Lundell and other breeze-producing machines, which, some years ago, were considered a luxury, but have long since asserted their places as household and business necessities. The goods handled by the Central Electric Company, in this as well as other lines, are so favorably known as regards quality, that the catalogue statements carry with them conviction which is reinforced by previous experience. The appreciation of an effective and reliable air-agitating device, like the Lundell, is shared by old and young alike, and the field of the fan motor is fast extending so as to include the humblest home, to judge from the pleasing picture on the booklet's cover. C. E. K.

John P. Barrett Resigns.

In the employ of the city of Chicago for 35 years, and for the past 25 years at the head of the electrical bureau as superintendent of the city telegraph, John P. Barrett tendered his resignation to Mayor Harrison on April 28 last. The causes which led to his resignation were primarily of a political nature, possibly aggravated by the recent newspaper attacks, alleging irregularities in his department.

Probably no city official, occupying or having occupied a similar position, has had an opportunity to watch the development of fire and police-alarm systems, from their earliest inception to their present high state of perfection and reliability, as has Mr. Barrett, and it is but just to state that in no small degree is credit due him for conceiving a number of improvements and time-saving devices in the service.

Occupying the position of City Electrician during the World's Fair period, it was but natural that the choice of Chief of the Electrical Department should fall upon him, and the efficient and satisfactory manner with which he discharged the duties of that responsible office is a matter of public record.

TESLA ON THE HURTFUL ACTIONS OF LENARD AND ROENTGEN TUBES.

To the Editor of Electrical Review:

The rapidly extending use of the Lenard and Roentgen tubes or Crookes bulbs as implements of the physician, or as instruments of research in laboratories, makes it desirable, particularly in view of the possibility of certain hurtful actions on the human tissues, to investigate the nature of these influences, to ascertain the conditions under which they are liable to occur and—what is most important for the practitioner—to render all injury impossible by the observance of certain rules and the employment of unfailing remedies.

As I have stated in a previous communication to your esteemed journal (see Electrical Review of December 2, 1896), no experimenter need be deterred from using freely the Roentgen rays for fear of a poisonous or deleterious action, and it is entirely wrong to give room to expressions of a kind such as may tend to impede the progress and create a prejudice against an already highly beneficial and still more promising discovery; but it can not be denied that it is equally uncommendable to ignore dangers now when we know that, under certain circumstances, they actually exist. I consider it the more necessary to be aware of these dangers, as I foresee the coming into general use of novel apparatus, capable of developing rays of incomparably greater power. In scientific laboratories the instruments are usually in the hands of persons skilled in their manipulation and capable of approximately estimating the magnitude of the effects, and the omission of necessary precautions is, in the present state of our knowledge, not so much to be apprehended; but the physicians, who are keenly appreciating the immense benefits derived from the proper application of the new principle, and the numerous amateurs who are fascinated by the beauty of the novel manifestations, who are all passionately bent upon experimentation in the newly opened up fields, but many of whom are naturally not armed with the special knowledge of the electrician—all of these are much in need of reliable information from experts, and for these chiefly the following lines are written. However, in view of the still incomplete knowledge of these rays, I wish the statements which follow to be considered as devoid of authoritativeness, other than that which is based on the conscientiousness of my study and the faith in the precision of my senses and observations.

Ever since Professor Roentgen's discovery was made known I have carried on investigations in the direction indicated by him, and with perfected apparatus, producing rays of much greater intensity than it was possible to obtain with the usual appliances. Commonly, my bulbs were capable of showing the shadow of a hand on a phosphorescent screen at distances of 40 or 50 feet, or even more, and to the action of these bulbs myself and several of my assistants were exposed for hours at a time, and although the exposures took place every day, not the faintest hurtful action was noted—as long as certain precautions were taken. On the contrary, be it a coincidence, or an effect of the rays, or the result of some secondary cause present in the operation of the bulbs—as, for example, the generation of ozone—my own health, and that of two persons who were daily under the influence of the rays, more or less, has materially improved, and, whatever be the reason, it is a fact that a troublesome cough with which I was constantly afflicted has entirely disappeared, a similar improvement being observed on another person.

In getting the photographic impressions or studying the rays with a phosphorescent screen, I employed a plate of thin aluminum sheet or a gauze of aluminum wires, which was interposed between the bulb and the person, and connected to the ground directly or through a condenser. I adopted this precaution because it was known to me, a long time before, that a certain irritation of the skin is caused by very strong streamers, which, mostly at small distance, are formed on the body of a person through the electrostatic influence of a terminal of alternating high potential. I found that the occurrence of these streamers and their hurtful consequence was completely prevented by the employment of a conducting object, as a sheet of wire gauze placed and connected as described. It was observed, however, that the injurious effects mentioned did not seem to diminish gradually with the distance from the terminal, but ceased abruptly, and I could give no other explanation for the irritation of the skin which would be as plausible as that which I have expressed; namely, that the effect was due to ozone, which was abundantly produced. The latter peculiarity mentioned was also in agreement with this view, since the generation of ozone ceases abruptly at a definite distance from the terminal, making it evident that a certain intensity of action is absolutely required, as in a process of electrolytic decomposition.

In carrying further my investigations, I gradually modified the apparatus in several ways, and immediately I had opportunities to observe hurtful influences following the exposures. Inquiring now what changes I had introduced, I found that I had made three departures from the plan originally followed: First, the aluminum screen was not used; second, a bulb was employed which, instead of aluminum, contained platinum, either as electrode or impact plate; and third, the distances at which the exposures took place were smaller than usual.

It did not require a long time to ascertain that the interposed aluminum sheet was a very effective remedy against injury, for a hand could be exposed for a long time behind it without the skin being reddened, which otherwise invariably and very quickly occurred. This fact impressed me with the conviction that, whatever the nature of the hurtful influences, it was in a large measure dependent either on an electrostatic action, or electrification, or secondary effects resulting therefrom, such as are attendant to the formation of streamers. This view afforded an explanation why an observer could watch a bulb for any length of time, as long as he was holding the hand in front of the body, as in examining with a fluorescent screen, with perfect immunity to all parts of his body, with the exception of the hand. It likewise explained why burns were produced in some instances on the opposite side of the body, adjacent to the photographic plate, whereas portions on the directly exposed part of the body, which were much nearer to the bulb, and consequently subjected to by far stronger rays, remained unaffected. It also made it easy to understand why the patient experienced a prickling sensation on the exposed part of the body whenever an injurious action took place. Finally, this view agreed with the numerous observations that the hurtful actions occurred when air was present, clothing, however thick, affording no protection, while they practically ceased when a layer of a fluid, quite easily penetrated by the rays, but excluding all contact of the air with the skin, was used as a preventive.

Following, now, the second line of investigation, I compared bulbs containing aluminum only with those in which platinum was used besides, ordinarily as impact body, and soon there were enough evidences on hand to dispel all doubt as to the latter metal being by far the more injurious. In support of this statement, one of the experiences may be cited which, at the same time, may illustrate the necessity of taking proper precautions when operating bulbs of very high power. In order to carry out comparative tests, two tubes were constructed of an improved Lenard pattern, in size and most other respects alike. Both contained a concave cathode or reflector of nearly two inches in diameter, and both were provided with an aluminum cap or window. In one of the tubes the cathodic focus was made to coincide with the center of the cap, in the other the cathodic stream was concentrated upon a platinum wire supported on a glass stem axially with the tube a little in front of the window, and in each case the metal of the latter was thinned down in the central portion to such an extent as to be barely able to withstand the inward air pressure. In studying the action of the tubes, I exposed one hand to that containing aluminum only, and the other to the tube with the platinum wire. On turning on the former tube, I was surprised to observe that the aluminum window emitted a clear note, corresponding to the rythmical impact of the cathodic stream. Placing the hand quite near the window, I felt distinctly that something warm was striking it. The sensation was unmistakable, and, quite apart from the warmth felt, differed very much from that prickling feeling produced by streamers or minute sparks. Next I examined the tube with the platinum wire. No sound was emitted by the aluminum window, all the energy of the impact being seemingly spent on the platinum wire, which became incandescent, or else the matter composing the cathodic stream was so far disintegrated that the thin metal sheet offered no material obstruction to its passage. If big lumps are hurled against a wire netting with large meshes, there is considerable pressure exerted against the netting; if, on the contrary—for illustration—the lumps are very small as compared with the meshes, the pressure might not be manifest. But, although the window did not vibrate, I felt, nevertheless, again, and distinctly, that something was impinging against the hand, and the sensation of warmth was stronger than in the previous case. In the action on the screen there was apparently no difference between the two tubes, both rendering it very bright, and the definition of the shadows was the same, as far as it was possible to judge. I had looked through the screen at the second tube a few times only when something detracted my attention, and it was not until about 20 minutes later, when I observed that the hand exposed to it was much reddened and swollen. Thinking that it was due to some accidental injury, I turned again to the examination of the platinum tube, thrusting the same hand close to the window, and now I felt instantly a sensation of pain, which became more pronounced when the hand was placed repeatedly near the aluminum window. A peculiar feature was that the pain appeared to be seated, not at the surface, but deep in the tissues of the hand, or rather in the bones. Although the aggregate exposure was certainly not more than half a minute, I had to suffer severe pain for a few days afterward, and some time later I observed that all the hair was destroyed and that the nails on the injured hand had grown anew.

The bulb containing no platinum was now experimented with, more care being taken, but soon its comparative harmlessness was manifest, for, while it reddened the skin, the injury was not nearly as severe as with the other tube. The valuable experiences thus gained were: The evidence of something hot striking the exposed member; the pain *instantly* felt; the injury produced *immediately* after the exposure, and the increased violence due, in all probability, to the presence of the platinum.

Some time afterward I observed other remarkable actions at very small distances from powerful Lenard tubes. For instance, the hand being held near the window only for a few seconds, the skin seems to become tight, or else the muscles are stiffened, for some resistance is experienced in closing the fist, but upon opening and closing it repeatedly the sensation disappears, apparently no ill effect

(Continued on page 211.)

FINANCIAL PRACTICE AND ENGINEERING METHODS OF AMERICAN STREET RAILWAYS.

DELIVERED BEFORE THE NEW YORK ELECTRICAL SOCIETY, AT COLUMBIA COLLEGE, APRIL 7, 1897, BY E. E. HIGGINS.

(Continued from page 189.)

President Emery: The speaker has just conferred with me and raises the question as to whether he shall go into the engineering branch of the matter or not, or whether we shall discuss what we have heard. I should like some expression in regard to the matter. It is fairly late.

Mr. Higgins: I think it is an imposition to ask anybody to stay later than 10 o'clock to hear an address of this character. We were a little late in starting. I had intended to occupy about an hour and a half or two hours' time.

Mr. Perry: We have had a most interesting address upon a subject in which we are all interested, and I am sure that none of us came here with so large a view of the subject as we shall take away with us, and I move a vote of thanks to Mr. Higgins for his admirable address.

President Emery: The question is now whether we shall go on with the engineering part of the question, or take up the discussion of the matter as far as we have gone.

Mr. Higgins: I think the question is simply a matter of sticking to the title, and that is not nearly so important as it is to let the audience retire if they desire to.

President Emery: I will bear in mind the motion of Mr. Perry a little later. There are quite a number here interested in railroad matters, and we would like to hear from them. While it is in mind, I may say that in making an examination of this question of operating expenses per car mile, I discovered a rather curious relation. I did not have the advantage of so many sources of information as the speaker, but I see he has not carried the line out in full; it is only for three States; but comparing the results for a number of steam roads and a number of electric roads, as they could be obtained, the surprising fact developed that the cost per car mile is fairly uniform for both kinds of roads. The question arises at once—how is it possible with such different methods, cars of different sizes and different means of propulsion? It comes about much in this way—while we have smaller cars and cars of less weight on the electric railroads, still the traction resistance is much higher, and so the cost per car mile is not so very different. I have been able to find results varying from five cents for a single road and then starting in at about 9 or 10 cents and running up to over 20 cents; but most of the variations will come in between 11 and 15 cents per car mile for the better class of double roads. There is a variation in regard to the roads at Boston. The West End road particularly requires very large expenditure per car mile, and that has been explained by the fact that in changing from horse cars to electricity they have not been able to increase the speed. They have increased the capacity, but have been so crowded that it has been impossible to increase the speed, and therefore they have not been able to make the number of miles with the equipment and with the force that is desirable to reduce this cost. This, probably, will be much changed when the tunnel which they are building is completed. In other places where they can run faster, it makes a considerable difference. In looking at these figures, there is one thing which is very often overlooked. What is the principal item of expense? The coal is not; in fact, it would be better if a great many stations had been built with a cheaper equipment and had been put in with a loss in the coal account. But the labor account frequently runs up to 15 per cent of the operating expenses, and is 45 per cent in a great many cases. Therefore, if a manager takes his cars and lets them stand on side tracks, he is saving power, which costs little or nothing, comparatively, but the time of the men is running on constantly, and necessarily he is losing money; and the same thing is true if he is running slowly. This is only one of the points which have come up in my mind in relation to this very interesting lecture, and I know there are a large number of others which would be interesting to have brought out if the gentlemen present will give their experience and ideas. Will Mr. Mailloux give his views.

Mr. Mailloux: I came here only a few moments since, owing to a previous engagement, and, consequently, having lost so much of the first part of the discourse, I do not feel that I am capable of saying much about it. It is, in fact, an address on a special subject by a man who may be said to be the only specialist on it, and I do not think it is within the province of any of us to criticise it. I have been much interested in what I have heard, and am sorry that the discourse has been shortened or interrupted. I have attended meetings where we have remained until 11 o'clock to hear much less interesting dissertations, and I think we could well afford, as there is so little disposition to enter into a discussion, to have the speaker proceed to give us further details about that portion of the question which necessarily will interest those of us who are engineers. I shall be willing to stay until half-past eleven, if necessary, and there must be others who will do the same. (Applause.)

President Emery: I think, perhaps, it would be better to discuss this part of the subject and take up the other and make it a separate discussion. We have the good fortune to have Mr. Vreeland with us, and we would like to hear from him.

Mr. H. H. Vreeland: Mr. President and gentlemen, I agree with the former speaker. We street railroad managers sit at Mr. Higgins's feet to learn. It would be just as fair to pit Russell Sage against Dr. Rainsford in a game of golf as to pit me against Higgins on financial questions in conjunction with street railroads, or to pit Sam Jones against Chauncey Depew in a talk to the young ladies of Vassar College. If I were to discuss this question at all, and follow what the speaker has said, it would simply be to cover the same ground of argument as he has, as I have learned it from him in reading the *Street Railway Journal*.

President Emery put the question on continuing the address, which was adopted affirmatively.

Mr. Higgins: The question of power station is, perhaps, in one sense, at the root of the whole problem of the operation of an electric railway; and in another sense it is not, because the cost of power is a small proportion of the whole expense. The power station, however, is usually the pet of the street railway managers, and it is given more attention, perhaps, than is really due to it from some points of view. In the original power stations a 150-kilowatt machine was a monster—a subject for admiration, and was only put in after considerable experience with 50, 60 and 80-kilowatt machines had demonstrated that they could be replaced easily by larger ones, and to advantage. Since that time we have gone by successive leaps to 500, 1,000 and 1,500 kilowatts and 2,000-horse-power units. We have passed from bolted machines, high-speed engines, to direct-connected engines, the engine speeds going up and the dynamo speeds coming down to meet each other, until now we have engines which are run up pretty nearly to the limit of speed, and dynamos which can be run at greater speeds for great output, but have to be run less economically as to the investment account, in order to be direct connected to the generators. We find, coincident to this, that the areas of the power stations are coming down to very moderate limits, and that the cost of real estate is, therefore, becoming a less marked feature of street railway investment. I imagine it would be surprising to make a comparative estimate of the cost of real estate and buildings necessary for operating an electric railway plant with those of the buildings necessary for operating a horse railway plant of the same size. I think the figures for the horse road would be several times those for the electric road.

The boilers used in street railroad work at the present time are almost without exception of the water-tube type, although there are quite a number of horizontal tubular boilers in use, the principal advantage of a water-tube boiler being the quickness with which it answers to a call for power, which is put almost instantly a thousand times a day on the steam space. The more sluggish horizontal tubular boilers sometimes have pretty dangerous conditions developed in them through their inability to quickly respond to this call, the surplus of water being small. As far as the ordinary features of the boiler house are concerned, these are known to all, and may be passed over briefly with the statement that there are self-feeding grates, grates for using small coal, buckwheat and slack, and a good deal of care is taken latterly to prevent the formation of smoke in the furnace by providing more perfect combustion, it being generally conceded that smoke-consuming devices do not reach the root of the difficulty, and you must go further back and get at the heart of the problem in securing perfect combustion of gases in the furnace. The engines, which were originally high-speed engines run with belts, are now, as I said before, much lower speeds, and Corliss valves are in a large proportion of the engines. There are other valves which have given excellent service, and there are medium-speed machines which some people swear by, but, as a rule, I think one would hesitate to-day to put in direct-connected generators in any plant of 500 kilowatts capacity.

As an illustration of the difference between American engineering and foreign engineering, a curious thing came to my attention during the last month, where a road, serving a city of about 175,000 people, is actually building seven power stations, each having a capacity of about 300 kilowatts, to operate these comparatively small lines, there being 60 or 70 miles in all. It seems a rather strange thing to stretch out stations in this manner, and to multiply the cost. The idea in this country is concentration, although I believe the idea of concentration can be carried too far, and has been in some cases. I think we are coming to a point where the burden of copper is going to be too much to be stood, and some relief must be found.

The efficiency of our dynamos is so high that it seems difficult to improve them. I imagine that this is, perhaps, the most stable part of a street railway plant, as far as efficiency is concerned and intrinsic economy, but, of course, things may come up to make even that a subject of development. Switchboard appliances are all as nearly perfect as can be. As to the methods of power station distribution, there is nothing special to be said, except that I believe that the power coming out of a station should be metered, and it is not metered enough at the present time. The true basis for the determination of comparative power-station economy between systems, and from year to year on the same system, is found in the kilowatt hour unit. Water power is used in a good many places and with considerable success, the form of regulation varying according to the amount of power. Where the power is ample for all requirements and the surplus can not be sold, there seems to be no material objection to regulating the power, as is done in one case by the introduction of rheostats to take up the surplus power, the rheostats being switched in automatically as the current consumption of the outside circuits goes down. It is an extremely wasteful means of regulation, and if you did not have Niagara Falls behind you, you could hardly use it. I believe they have contrived an excellent automatic regulating gate, so that the output is not difficult to govern, and fluctuations of electro-motive force and current can easily be taken care of. As far as the lines of development are concerned, as to the future of the power stations, I am inclined to think that on the present lines there is little to be expected. Steam engineering in its present state has been the result of so many years of development and study and investigation that we can hardly get above the economy in the engines that we have to-day, and as I have already said, the efficiency of dynamos is so great that the consumption of coal per kilowatt output is about as low as we may expect to find it under any of the present lines of engineering. There are two possibilities of the future which must not be lost sight of in providing against contingencies. One of them is the much-longed-for direct conversion of coal into electricity, which will save, where there is a field for saving, perhaps 85 per cent of the engineering cost. The actual saving might be only 15 to 20 per cent, and it would double the present economy. There is another field which is nearer than that, perhaps, and that is in the use of turbines instead of the engines, and that field is less in the economy which will be introduced by their use than the reduction in the investment cost. Economy of turbines is likely to be slightly in excess of engines; the cost may be only one-tenth or one-twentieth as much. I think we are nearer the turbine era to-day than ever before, and I am inclined to think it is only a short time away, although knowing that this is not the generally-accepted view.

[To be concluded.]

The Telegraphic Historical Society of North America.

Secretary George C. Maynard, of Washington, is sending out to members of the society the latest instalment of the society's records. When the volume is completed an index will be supplied.

INDUSTRIAL NOTES.

The Ohio Brass Company, Mansfield, Ohio, are producing a complete line of overhead trolley equipments.

A new junction box has recently been placed on the market by Pass & Seymour, porcelain manufacturers, of Syracuse.

The Shelby Electric Company have the newly constructed factory at Shelby, Ohio, fully equipped, and, according to a statement of Secretary Fish, are running to fullest capacity.

A New York office has been opened at 39 Cortlandt street by the Onondaga Dynamo Company, of Syracuse, N. Y., which will be in charge of the company's general sales agent, Mr. W. L. Fairchild.

An elaborate switchboard equipment, said to be the largest in New York, is just being installed in the new Commercial Cable Building by the Electric Engineering and Supply Company, of Syracuse.

Much credit is due Mr. Fred M. Locke, of Victor, N. Y., in connection with the transmission of electric power for the special design of insulators which he has perfected for withstanding high currents.

The affairs of the Syracuse Storage Battery Company, of Syracuse, are now being closed by the receiver. It is said by the attorneys for the company that, after payment of dues to employés for services, probably little, or nothing, will be left for other creditors.

The Ohio Storage Battery, Cleveland, Ohio, have arranged with Mr. Kilbourne to take entire management of the sales department, and in the future Mr. Hoyt will supervise the manufacturing ends. The company have engaged additional office facilities in the Wade Building.

A representative of the ELECTRICAL REVIEW was shown through the large plant of the Warren Electric Manufacturing Company, at Sandusky, Ohio, recently. This factory is now in operation for the production of the "Warren" alternator, and ranks as one of the largest and most perfect electrical factories in the West.

The Electrical Supply Company, Madison, Wis., although incorporated only a few months ago, has, we learn, already built up quite a profitable trade among the many consumers throughout the northwestern States, such as Wisconsin, Minnesota, Iowa and Michigan. Mr. L. W. Burch is manager, and his extensive acquaintance with the trade will no doubt contribute largely to the company's success.

The season thus far has been a most successful one for the "Tuerk" alternating fan. The factory of the Hunter Fan and Motor Company, at Fulton, N. Y., the manufacturers, has been crowded for weeks to meet the requisitions of their agents and the supply dealers, and the company's eastern representatives, E. B. Latham & Company, 136 Liberty street, are finding an increased demand in this section.

Keystone Portable Voltmeters.

The Keystone Electrical Instrument Company, of Philadelphia, announce that they are now prepared to offer a complete line of portable voltmeters for combined use on the direct and alternating current.

This line of voltmeters is the result of a large number of experiments covering several years, followed by time tests in actual practice; therefore they feel that they are warranted in coming before the public with the statement that their portable voltmeters meet more fully than any similar line on the market the requirements of practical use under all conditions.

THE KEYSTONE PORTABLE VOLTMETER.

In the construction of these voltmeters nothing is incorporated which is subject to change or deterioration, and, having been calibrated from absolute standards of voltage, may be relied upon to maintain their accuracy. The system is such that there is no magnetic lag nor any error due to self-induction, therefore they are independent of frequency variations on the alternating current.

They are mounted in highly polished mahogany cases with key, lock and leather carrying handle. With each instrument is included a pair of flexible leads, for which a special compartment is provided.

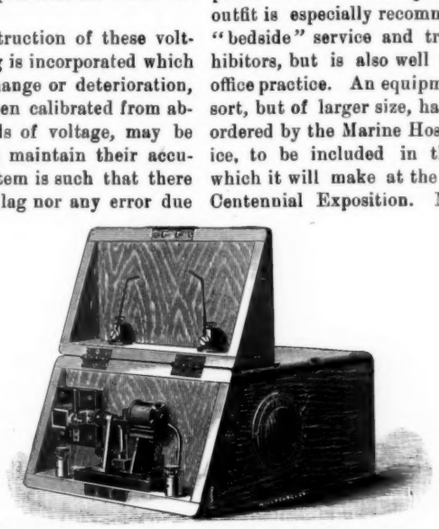
Two features are incorporated, which busy users will appreciate; one is that the instruments are deadbeat without the use of a mechanical brake, and the second is that each instrument is provided with a switch for reversing the direction of the current flow through the voltmeter when used on direct-current circuits. This latter enables the user to obtain mean readings easily and promptly, and further, by turning the switch to the dead-point, to throw the instrument out of circuit without disconnecting the leads.

These voltmeters are listed in ranges from 12 to 700 volts, single and double scales, so that all classes of testing work are provided for.

"W. S." Portable Induction Coil for X-Ray Work.

The illustration herewith shows a portable X-ray induction coil recently devised by Messrs. Willyoung & Company, of Philadelphia. The advantage of this coil consists in the fact that it can readily be carried from place to place, being constructed specially for such service, and thus enables a surgeon or exhibitor to convey the necessary apparatus from one place to another with minimum inconvenience.

This coil, as well as all other forms now made by Messrs. Willyoung & Company, is equipped with the new "Ideal" automatic interrupter, reversing switch and adjustable discharge points, as illustrated. The entire instrument is mounted in a portable oak case with outside dimensions 14 by 12 by 6½ inches, weighing less than 25 pounds. It is provided with lock and key and heavy metal handle. The spark length of this coil is from four and one-half to five inches, and such discharge can readily be obtained from two cells of chloride accumulators. With such combination and a Bowdoin focus tube of proper exhaustion, practically any X-ray work at present possible can be accomplished. The outfit is especially recommended for "bedside" service and traveling exhibitors, but is also well adapted to office practice. An equipment of this sort, but of larger size, has just been ordered by the Marine Hospital Service, to be included in the exhibit which it will make at the Tennessee Centennial Exposition. Mr. James G. Biddle, 910 Drexel Building, Philadelphia, sole agent for all apparatus manufactured by Messrs. Willyoung & Company, will be glad to supply further particulars in regard to the "W. S." portable induction coil, or other X-ray specialties of the same class.



"W. S." PORTABLE INDUCTION COIL FOR X-RAY WORK.

Extension of the B. & O. Electric Service.

The electric service of the B. & O. Railroad Belt Line, which has heretofore extended from the power house, corner of Howard and Hamburg streets, to the Mount Royal station, Baltimore, has been completed to Waverly, a distance of two miles. Hereafter, freight trains will be drawn to that point by the powerful electric locomotives. The object of the extension is to do away with the smoke nuisance in the Annex, and also to enable rapid transit over the heavy grades which lie between North avenue and the York road.

William M. Brooke.

The many friends of Mr. William M. Brooke, the popular representative of the Central Electric Company in Texas, will be glad to learn that Mr. Brooke's genial qualities, as well as his attention to the wants of his customers, have been recognized in an unusual manner by the Texas Gas and Electric Light Association at their recent meeting in San Antonio, Tex.

Mr. Goldrick, of the San Antonio Gas and Electric Light Company, on behalf of the Texas Gas and Electric Light Association, presented Mr. Brooke with a handsome gold medal, inscribed "The most popular lighting man in Texas".

Mr. Brooke's career in the electrical business began in the Fall of 1893, when he identified himself with the Central Electric Company, of Chicago, in a subordinate capacity. The management was quick to recognize Mr. Brooke's qualifications, and his progress, therefore, was very rapid, his experience as a salesman in other lines being quickly adapted to the intricacies of the electrical supply trade.

In 1894 Mr. Brooke was given full charge of the southwestern territory, with headquarters in New Orleans. The wisdom of placing this important territory in Mr. Brooke's hands is evidenced by the action of the Texas Gas and Electric Light Association, and justifies the judgment of the Central Electric Company in appointing him their representative in the territory mentioned.

New Electric Light Carbons.

After a long series of experiments in the factory of the Partridge Carbon Company, at Sandusky, Ohio, a new light carbon has been produced, which is thought by a number of experts will fully equal the foreign product. It has generally been believed an impossibility to make in this country a carbon which might be compared with the German and French product, and if the facts prove to be as now believed, the discovery will be important to the electric lighting field. The factory of the Partridge Carbon Company may be enlarged at the present site, or, as Mr. Speers, of the Partridge company, remarked, if "we enter this branch more actively, we may manufacture the light carbons in some other city and keep the enterprise distinct from the present company".

Working Full Time.

The Berlin Iron Bridge Company, employing 400 men at its extensive plant in East Berlin, Ct., has gone on full time.

At the annual meeting of the Tremont, Colo., Electric Light and Power Company the reports of the officers showed the affairs of the company to be in very satisfactory condition. The following officers were elected: M. A. Leddy, president; E. P. Creighton, vice-president; John Nolon, treasurer; H. N. Seigfried, secretary and manager.

Electrical Review

Times Building, 41 Park Row,

P. O. Box 2339. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

WESTERN OFFICE:
CARL E. KAMMEYER, Representative,
1627 MONADNOCK BLOCK, CHICAGO.

LONDON OFFICE:
HENRY W. HALL, Representative,
42 OLD BROAD STREET, LONDON, E. C.

News, Subscriptions and Advertisements.

Subscription to the
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10

Copies can only be supplied for one year back at 25 cents each.

Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, MAY 5, 1897.

CONTENTS.

	PAGE
Views, News and Interviews	205
Mr. Edison's Latest Photograph	205
Death of T. C. Price	205
The C & C Ironclad Motor	206
Literary	206
The Cashier's Electric Safety Cabinet	206
Western News Notes	206
John P. Barrett Resigns	206
Tesla on the Hurtful Actions of Lenard and Roentgen Tubes	207
Financial Practice and Engineering Methods of American Street Railways	208
The Telegraphic Historical Society of North America	208
Industrial Notes	209
Keystone Portable Voltmeters	209
"W. S." Portable Induction Coil for X-Ray Work	209
Extension of the B. & O. Electric Service	209
William M. Brooke	209
New Electric Light Carbons	209
Working Full Time	209
Standing in Open Cars	210
The Nashville Exposition	210
Personal	210
Arc Lighting in America and Europe	212
American Institute Fair	213
Electric Storage Battery Company	213
An Attractive Electrical Advertising Apparatus	213
Kind Words	213
Milwaukee Industrial Exhibition	213
Electric Light Flashes	213
General Electric Company's Fifth Annual Report	214
A Milwaukee Removal	215
Telephone News and Comment	215
Advance Information	216
Kindred Interests	ix
General Electric's Annual Report	x
Electrical Patents	x
National Electric Light Association	x

INDEX OF ADVERTISERS.

COVER PAGES.	PAGE
Abendroth & Root Mfg. Co., boilers	xvi
American Electrical Works, insulated wire	i
American Engine Co	xvi
Babcock & Wilcox Co	xvi
Bunnell & Co., J. H., dry batteries	i
C & C Electric Co	ii
Campbell & Zell Co	i
Clonbrock Steam Boiler Co	xvi
Crefeld Electrical Works	i
Crocker-Wheeler Electric Co	i
Day's Kerite, insulated wire	i, viii
Electric Appliance Co., supplies	i
Goubert Manufacturing Co	xvi
Hampson, E. P., & Co., engines	xvi
Imperial Porcelain Works	xvi
Iron Clad Rheostat Co	i
Locke, Fred M., insulators and line material	xvi
McKenney & Waterbury	i
Metropolitan Electric Co	ii
National Conduit & Cable Co	ii
New York Insulated Wire Co., Grimshaw wires and cables	i
New York & Ohio Co	i
Okonite Co., insulated wire	i, xvi
Partridge Carbon Co., motor and generator brushes	i
Safety Insulated Wire and Cable Co	i
Standard Paint Co., insulating compound	i
Stirling Co., water-tube boilers	xvi
Sunlight Company	xv
Tabor & Mayer	i
Thayer & Co	i
Van Nuis, C. S	i

INSIDE PAGES.	
American Bell Telephone Co	xiii
American Electric Telephone Co., long-distance telephones	xiii
American Electric Heating Corporation, electric stoves and car heaters	xi
American Engine Co	iv
Automatic Circuit Breaker Co	xiv
Baker & Co., platinum	xiv
Beacon Lamp Co., incandescent lamps	ix
Belknap Motor Co	xii
Berlin Iron Bridge Co	iii
Biddle, J. G	xi
"Big Four" R. R	x
Bogart, A. L	vii
Briil, J. G., Co	xiv
Brixey, W. R., Day's kerite wires and cables	viii
Brush Electric Co	v
Bryant Electric Company	vii
Bubier Publishing Co	xii
Buckeye Electric Co	ix
Bullock Electric Mfg. Co	xiv
Carborundum Co	xi
Carlisle & Finch	vii
Central Electric Co., electrical supplies	iii
Chicago Edison Co	vii
Coles, Walter S	x
Connecticut Pipe Mfg. Co	xiv
Diehl Manufacturing Co	iii
Dixie Company	x
Dixon, Jos., Crucible Co., belt dressing	vi
Duval, E. S., Jr., patents	x
Dyer & Driscoll, patent solicitors	x
Eastern Electric Cable Co	xi
Eastman Kodak Co	x
Electric Launch Co	vi
Electric Storage Battery Co	vii
Electrical Mercantile Agency	ix
Elwell-Parker Electric Co. of America	xii
Empire China Works, porcelain specialties	vi
Eppenger & Russell Co., Valentine subway electrical conduit	xiv
Equitable Life Assurance Society of the U. S	xiv
Faraday Carbon Co., carbons	viii
Farr Telephone & Construction Supply Company	vii
Forest City Electric Co	viii
Fort Wayne Electric Corporation	vi
Gordon-Burnham Battery Co	x
Green & Bauer	xi
Harrison Electric Co., telephone switchboards	xiii
Hawks, H. D	x
Hemingray Glass Co	ix
Hill, Jr., Thomas	ix
Hoopes & Townsend	xi
Huebel & Manger	ix
Hunter Fan and Motor Co	vi
India Rubber and Gutta Percha Insulating Co	iii
International Correspondence Schools	ix
Jewell Belting Co	iv
Keystone Electrical Instrument Co	viii
Knapp Electric & Novelty Co	ix
Knott, L. E., Apparatus Co	xi
Leffel & Co., Jas	vii
Lehigh Valley Creosoting Co., creosoted lumber	ix
Marshall, Wm., condensers	ix
McCaskey & Holcomb Co	ix
McIntire, C., Co	ix
New England Engineering Co	v
New York Telephone Co	xii
Novelty Electric Co., supplies	xi
Orient Electrical Co	ix
Ostrander, W. R., & Co., supplies	ix
Partrick & Carter Co., electrical supplies for housework	ix
Pettingell-Andrews Co	iv
Phillips Insulated Wire Co., wire	viii
Ridlon Co., Frank	vi
Royce & Marean, electrical supplies	xii
Schiff, Jordan & Co., carbons	viii
Sessions Foundry Co	xii
Siemens & Halske Electric Co. of America	xiii
Solar Carbon and Manufacturing Co	vi
Spring Park Laboratory	xi
Standard Telephone & Electric Co	xiii
Standard Thermometer & Electric Co	iv
Stanley Electric Mfg. Co., S. K. C	v
Sterling Supply & Mfg. Co	xiv
Utica Electrical Mfg. & Supply Co	vi
Viaduct Mfg. Co., telephones, etc	xii
Wedderburn & Co., John, patents	x
Western Electric Co	xii
Western Telephone Construction Co	xiii
Westinghouse Electric & Mfg. Co	iv
Weston Electrical Instrument Co., measuring instruments	viii
White & Co., J. G., engineers and contractors	ix
Whitney Electrical Instrument Co	ix

In our present issue we publish a communication from Nikola Tesla, giving, in an exhaustive and instructive manner, the results of his experiments with the Roentgen rays, relating chiefly to their deleterious actions on human tissues. The many novel facts which Mr. Tesla brings out, and his careful deduction from them, will afford valuable and most welcome information to the vast army of experimenters who are engaged in exploring this attractive field. Mr. Tesla, while recognizing the existence of certain grave perils, suggests safeguards and repeats his warning against statements prejudicial to the development of this new and wonderful art.

STANDING IN OPEN CARS.

They do some things better in Boston. For instance, no one may stand in open street cars. If the seats in a Summer car are all occupied, no one is allowed to board the car and obstruct the view of those who have paid for seats and are occupying them. This is eminently just. The prime object of an open car is to secure to the passenger light, air and a view of the passing scene. If the seats are full and other people come aboard, the latter must of necessity stand up. The only place to stand is in front of those people in the seats. The prime object of the open car is at once defeated. Conceive, if you can, anything more unpleasant on a hot day than a sweltering line of humanity in close contact standing in front of you. You got on the car to avoid them, but here they are again! If the street railway people in Boston succeed in keeping the "standees" off the cars, they deserve the thanks of mankind for the example set. Owing to the well known capacity of New Yorkers for long suffering in public places, we doubt very much whether such a rule could be made to work in the metropolis. But even so, it's worth trying.

There's trouble for the West Park Board in Chicago. It seems that the electric lighting plant recently installed in the West Park, at an expense of $200,000, and which has been so gleefully described by some of our contemporaries, doesn't stand up to its work. The matter has gone so far that an independent electrical expert has been called in to determine whether or not the specifications for the plant have been fulfilled. In view of the large expenditure, it is to be hoped that the plant can be made to perform its required functions.

The Citizens' Street Railway Company, of Indianapolis, has secured a temporary injunction from the United States Circuit Court, under which it may continue to charge a five-cent fare. This is the result of the recent three-cent fare agitation in that city, which we have already mentioned in these columns. The court seems to think that the law providing for three-cent fares is unconstitutional and violates vested property rights. It is probable that the matter will come before the United States Supreme Court for final adjudication.

Paris doctors claim to have discovered that continued exposure to the X rays will produce palpitations of the heart, which eventually become unendurable. We have no record in this country of any similar observations.

THE NASHVILLE EXPOSITION.

The Tennessee Centennial Exposition, at Nashville, was opened with fitting ceremonies on May 1. President McKinley touched a telegraph key in the White House at Washington and set the machinery going. The electrical features of the show promise to be interesting and instructive. It is to be hoped that the exposition will be a financial success. It will certainly do a great deal toward increasing the interest in Southern progress and development.

PERSONAL.

Mr. Frank J. Sprague, the well known electrical engineer, sailed from New York for London last week. He expects to be away about a month.

Captain Eugene Griffin, first vice-president of the General Electric Company, returned to New York city last week after several months' absence in Europe.

Mr. W. J. Clark, general manager of the General Electric Company's railway department, sailed for Europe last Saturday on the "Umbria". A number of Mr. Clark's friends were at the pier to see him off.

The engineering staff of the Standard Air-Brake Company, of New York city, has been increased by the addition of Mr. Edward H. Dewson, Jr., with whom General Manager Wessels lately closed a contract for a term of years. Mr. Dewson brings to the company a ripe experience. He entered upon his new field April 26. Mr. Dewson has been long and favorably known in connection with his work while with the General Electric Company in their engineering department, and in connection with locomotive practice and the superintendency of one of the western lines. He has for some time filled the position of master mechanic for the Pratt & Letchworth company, of Buffalo. Mr. Dewson is thoroughly posted on the mechanical arts, and will find full scope for his ability in his new field.

The following-named out-of-town visitors registered at the headquarters of the National Electric Light Association, 136 Liberty street, during the week ended April 30: J. H. Bowker, Philadelphia, Pa.; James Clark, Plainfield, N. J.; Wilson Kistler, J. H. Fredericks, Lock Haven, Pa.; O. W. Ruggles, Chicago, Ill.; L. A. Robinson, Pittsburgh, Pa.; A. J. Smith, B. F. Horner, Cleveland, Ohio; F. J. Moore, Buffalo, N. Y.; Frank Van Dusen, Pittsburgh, Pa.; H. J. Caukins, Detroit, Mich.; Geo. W. Vallee, J. R. Wood, Philadelphia, Pa.; W. E. Davis, Montreal, Can.; D. B. Martin, Chas. Schryver, Baltimore, Md.; C. E. Lambert, Haverstraw, N. Y.; J. W. Packard, Warren, Ohio; W. H. Dearborn, Philadelphia, Pa.; C. F. Munder, Springfield, Mass.; Jas. I. Ayer, Boston, Mass.; A. M. Young, Waterbury, Ct.; J. H. Reid, Pittsburgh, Pa.

TESLA ON THE HURTFUL ACTIONS OF LENARD AND ROENTGEN TUBES.

(Continued from page 207.)

remaining. I have, furthermore, observed a decided influence on the nasal discharge organs similar to the effects of a cold just contracted. But the most interesting observation in this respect is the following: When such a powerful bulb is watched for some time, the head of the observer being brought very close, he soon after that experiences a sensation so peculiar that no one will fail to notice it when once his attention is called to it, it being almost as positive as touch. If one imagines himself looking at something like a cartridge, for instance, in close and dangerous proximity, and just about to explode, he will get a good idea of the sensation produced, only, in the case of the cartridge, one can not render himself an account where the feeling exactly resides, for it seems to extend all over the body, this indicating that it comes from a general awareness of danger resulting from previous and manifold experiences, and not from the anticipation of an unpleasant impression directly upon one of the organs, as the eye or the ear; but, in the case of the Lenard bulb, one can at once, and with precision, locate the sensation: it is in the head. Now, this observation might not be of any value except, perhaps, in view of the peculiarity and acuteness of the feeling, were it not that exactly the same sensation is produced when working for some time with a noisy spark gap, or, in general, when exposing the ear to sharp noises or explosions. Since it seems impossible to imagine how the latter could cause such a sensation in any other way except by directly impressing the organs of hearing, I conclude that a Roentgen or Lenard tube, working in perfect silence as it may, nevertheless produces violent explosions or reports and concussions, which, though they are inaudible, take some material effect upon the bony structure of the head. Their inaudibility may be sufficiently explained by the well founded assumption that not the air, but some finer medium, is concerned in their propagation.

But it was in following up the third line of inquiry into the nature of these hurtful actions, namely, in studying the influence of distance, that the most important fact was unearthed. To illustrate it popularly, I will say that the Roentgen tube acts exactly like a source of intense heat. If one places the hand near to a red-hot stove, he may be instantly injured. If he keeps the hand at a certain small distance, he may be able to withstand the rays for a few minutes or more, and may still be injured by prolonged exposure; but if he recedes only a little farther, where the heat is slightly less, he may withstand the heat in comfort and any length of time without receiving any injury, the radiations at that distance being too weak to seriously interfere with the life process of the skin. This is absolutely the way such a bulb acts. Beyond a certain distance no hurtful effect whatever is produced on the skin, no matter *how long* the exposure. The character of the burns is also such as might be expected from a source of high heat. I have maintained, in all deference to the opinions of others, that those who have likened the effects on the skin and tissues to sunburns have misinterpreted them. There is no similarity in this respect, except in so far as the reddening and peeling of the skin is concerned, which may result from innumerable causes. The burns, when slight, rather resemble those people often receive when working close to a strong fire. But when the injury is severe, it is in all appearances like that received from contact with fire or from a red-hot iron. There may be no period of incubation at all, as is evident from the foregoing remarks, the rays taking effect immediately, not to say instantly. In a severe case the skin gets deeply colored and blackened in places, and ugly, ill-foreboding blisters form; thick layers come off, exposing the raw flesh, which, for a time, discharges freely. Burning pain, feverishness and such symptoms are of course but natural accompaniments. One single injury of this kind, in the abdominal region, to a dear and zealous assistant—the only accident that ever happened to any one but myself in all my laboratory experience—I had the misfortune to witness. It occurred before all these and other experiences were gained, following directly an exposure of five minutes at the fairly safe distance of 11 inches to a very highly-charged platinum tube, the protecting aluminum screen having been unfortunately omitted, and it was such as to fill me with the gravest apprehensions. Fortunately, frequent warm baths, free application of vaseline, cleaning and general bodily care soon repaired the ravages of the destructive agent, and I breathed again freely. Had I known more than I did of these injurious actions, such unfortunate exposure would not have been made; had I known less than I did, it might have been made at a smaller distance, and a serious, perhaps irremediable, injury might have resulted.

I am using the first opportunity to comply with the bitter duty of recording the accident. I hope that others will do likewise, so that the most complete knowledge of these dangerous actions may soon be acquired. My apprehensions led me to consider, with keener interest than I would have felt otherwise, what the probabilities were in such a case of the internal tissues being seriously injured. I came to the very comforting conclusion that, no matter what the rays are ultimately recognized to be, practically all their destructive energy must spend itself on the surface of the body, the internal tissues being, in all probability, safe, unless the bulb would be placed in very close proximity to the skin, or else, that rays of far greater intensity than now producible were generated. There are many reasons why this should be so, some of which will appear clear from my foregoing statements referring to the nature of the hurtful agencies, but I may be able to cite new facts in support of this view. A significant feature of the case reported may be mentioned. It was observed that on three places, which were covered by thick bone buttons, the skin was entirely unaffected, while it was entirely destroyed under each of the small holes in the buttons. Now, it was impossible for the rays, as investigation showed, to reach these points of the skin in straight lines drawn from the bulb, and this would seem to indicate that not all the injury was due to the rays or radiations under consideration, which unmistakably propagate in straight lines, but that, at least in part, concomitant causes were responsible A further experimental demonstration of this fact may be obtained in the following manner: The experimenter may excite a bulb to a suitable and rather small degree, so as to illuminate the fluorescent screen to a certain intensity at a distance of, say, seven inches. He may expose his hand at that distance, and the skin will be reddened after a certain duration of exposure. He may now force the bulb up to a much higher power, until, at a distance of 14 inches, the screen is illuminated even stronger than it was before at half that distance. The rays are now evidently stronger at the greater distance, and yet he may expose the hand a very long time, and it is safe to assert that he will not be injured. Of course, it is possible to bring forth arguments which might deprive the above demonstration of force. So, it might be stated, that the actions on the screen or photographic plate do not give us an idea as to the density and other quantitative features of the rays, these actions being entirely of a qualitative character. Suppose the rays are formed by streams of material particles, as I believe, it is thinkable that it might be of no particular consequence, in so far as the visible impression on the screen or film is concerned, whether a trillion of particles per square millimetre strike the sensitive layer or only a million, for example; but with the actions on the skin it is different; these must surely and very materially depend on the quantity of the streams.

As soon as the before-mentioned fact was recognized, namely, that beyond a certain distance even the most powerful tubes are incapable of producing injurious action, no matter how long the exposure may last, it became important to ascertain the safe distance. Going over all my previous experiences, I found that, very frequently, I have had tubes which at a distance of 12 feet, for illustration, gave a strong impression of the chest of a person with an exposure of a few minutes, and many times persons have been subjected to the rays from these tubes at a distance of from 18 to 24 inches, the time of exposure varying from 10 to 45 minutes, and never the faintest trace of an injurious action was observed. With such tubes I have even made long exposures at distances of 14 inches, always, of course, through a thin sheet or wire gauze of aluminum connected to the ground, and, in each case, observing the precaution that the metal would not give any spark when the person was touching it with the hand, as it might sometimes be when the electrical vibration is of extremely high frequency, in which case a ground connection, through a condenser of proper capacity, should be resorted to. In all these instances bulbs containing only aluminum were used, and I therefore still lack sufficient data to form an exact idea of what distance would have been safe with a platinum tube. From the case previously cited, we see that a grave injury resulted at a distance of 11 inches, but I believe that, had the protecting screen been used, the injury, if any, would have been very slight. Taking all my experiences together, I am convinced that no serious injury can result if the distance is greater than 16 inches and the impression is taken in the manner I have described.

Having been successful in a number of lines of inquiry pertaining to this new department of science, I am able at present to form a broader view of the actions of the bulbs, which, I hope, will soon assume a quite definite shape. For the present, the following brief statement may be sufficient. According to the evidences I am obtaining, the bulb, when in action, is emitting a stream of small material particles. There are some experiments which seem to indicate that these particles start from the outer wall of the bulb; there are others which seem to prove that there is an actual penetration of the wall, and, in the case of a thin aluminum window, I have now not the least doubt that some of the finely disintegrated cathodic matter is actually forced through. These streams may simply be projected to a great distance, the velocity gradually diminishing without the formation of any waves, or they may give rise to concussions and longitudinal waves. This, for the present consideration, is entirely immaterial, but, assuming the existence of such streams of particles, and disregarding such actions as might be due to the properties, chemical or physical, of the projected matter, we have to consider the following specific actions:

First. There is the thermal effect. The temperature of the electrode or impact body does not in any way give us an idea of the degree of heat of the particles, but, if we consider the probable velocities only, they correspond to temperatures which may be as high as 100,000 degrees centigrade. It may be sufficient that the particles are simply at a high temperature to produce an injurious action, and, in fact, many evidences point in this direction. But against this is the experimental fact that we can not demonstrate such a transference of heat, and no satisfactory explanation is found yet, although, in carrying my investigations in this direction, I have arrived at some results.

(Concluded on page X.)

ARC LIGHTING IN AMERICA AND EUROPE.

ABSTRACT OF A PAPER READ BEFORE THE CHICAGO ELECTRICAL ASSOCIATION, APRIL 16, 1897, BY C. WILER.

Scarcely more than 17 years have elapsed since arc lighting became a commercial art. In this short span of time artificial illumination by the voltaic arc not only excelled all other competitive systems, but has even become an important factor in the rapid development of our modern civilization. A branch of industry which is common property is subject to the individual character of the nation and to influences and changes due to the different social, commercial and geographical causes. America, which in the latter half of this century has taken such a prominent place in the technical world, was made quicker to see the great future of arc lighting than was slow, precautious Europe. The conditions of this country were more favorable for the adoption of the new method of illuminating than they were in the Old World. Here an immense area of land and an immense population are under the rule of one general government. American cities are very lenient in allowing the use of their streets, and do not impose the financial and technical restrictions that are ordinarily imposed abroad. Europe, on the other hand, is split up into many large and small States with different customs, racial peculiarities and animosities. The municipal administrations are very careful in the granting of franchises. They keep a watchful eye on the appearance of the streets and wait until a system has been thoroughly tried before they introduce it; but by their strict rules they often check the development of an industry, which in its infancy needs a helping hand. In America, arc lighting was considered a necessity while it was a luxury in Europe. It is no wonder, then, that the streets of American cities and towns have been glittering in the splendor of the electric light while Europeans were still content with gas and oil, and thus, too, it became possible that the keen foresight and genius developed in our country a system which allowed of an economical distribution over a large area, and left nothing to be desired as regards simplicity.

Series arc lighting with constant-current dynamos of varying electromotive force found its birthplace, its application and its perfection in America. Up to date it could hardly gain a foothold on the European continent. It was adopted in England at the time that the Brush and Thomson-Houston machines made their first appearance, and, although the plants are still running and a few have been added, the system has been nearly entirely abandoned. The desire to supply arc and incandescent light, as well as the motive power, from one and the same generator, the once low efficiency of arc dynamos, the use of small high-speed units, the consequently inferior arrangement of the steam plant, and last, but not least, the high pressure for interior lighting, are the objections made abroad against high-tension series arc lighting. Some of these objections have of late years been overcome in our land since larger units were built. The speed of arc dynamos has been decreased and, hand in hand therewith, their efficiency has been increased, so that to-day the commercial efficiency of a 60-light dynamo reaches 82 to 83 per cent; of a 100-light, about 86 per cent. Since, however, the speed has been decreased to about 800 revolutions per minute for 60-light dynamos, and to about 500 to 600 revolutions per minute for 100-light dynamos, it has been made possible to escape that labyrinth of countershafts, belts, pulleys, clutches and bearings, which for many years was characteristic of an arc plant. This enabled an economical arrangement of the steam plant. The countershaft can be avoided; arc dynamos have been direct connected with the steam engine.

Series arc lighting predominates in America. Arc lighting by constant-potential circuits was developed much later than in Europe. It has come into extensive use here since 1891, especially in large cities for private lighting. Most of the large direct-current supply stations for light and motive power here and abroad use the three-wire system with 220 volts across the outers, in Germany in conjunction with storage batteries. Plants which serve mainly for arc lighting on the European continent use the two-wire system with a pressure from 110 to 650 volts. The turning on or off of public street lamps, which are connected with constantly supplied circuits, is mostly done by hand when the area covered is small. When the supply extends over a large area, street lamps are turned on or off from the station or the distribution point. Each circuit, with from 2 to 12 lamps in series, is controlled from the station switchboard or from the distribution center, where the necessary measuring instruments for each circuit (ammeter, voltmeter, polarity indicator and rheostats) are placed.

In the combined arc and railway plants of the city of Munich the voltage of the generators is 640; 12 lamps are connected in series in one circuit. The feeders are run to well designed distribution centers, which are located on the street, and resemble patrol boxes in their exterior appearance. From here the arc circuits branch out. The all-night circuits are connected with the same side of the bus bars in the distribution center as the incoming feeder, while the 12 o'clock circuits are connected with the other side. Both sides can be disconnected by an automatic cut-out, the fine wire winding of which is connected with a test wire which indicates in the station the voltage of the feeder end. By short-circuiting the voltmeter in the station the current rises sufficiently to operate the automatic cut-out, which disconnects the desired circuits. In the old part of the plant the three-wire system is used for the feeders as well as for the arc circuits. The all-night lamps are placed on one side of the neutral, the midnight lights on the other. The three-wire system is changed into a two-wire system after midnight; the disconnected dynamo can be used for the charging of a storage battery during the rest of the night.

Thus far only direct-current distribution systems have been considered. Alternating arc lighting has been kept in the background both here and abroad. Only within a few years has it come into a more extensive use, especially in the European continental countries, where it is no longer regarded as much inferior to direct-current lighting. The success is to some extent due to moderate frequencies, to the use of the very best proper size, and even special carbons, and to the prevailing tendency of using lamps with a very fine adjustment and slow feed.

Alternating street lamps are connected in America with an individual transformer, the secondary voltage of which is 30 to 40, the primary mostly 1,000 or 2,000. This does not require a great amount of wire, allows an economical distribution over a large area, makes the lamps independent of each other and avoids a complicated lamp mechanism. It has the drawback of requiring a special transformer for each lamp. When alternating arc lamps are connected with incandescent circuits, the lamp voltage is obtained either by the introduction of sufficient resistance, by a transformer, or by a choking coil, usually called an economy coil. The coils are wound either for 50-volt circuits for the connection of one or two lamps, or for 100 to 110-volt circuits for the connection of one to three lamps. Some are arranged so that the lamps can be turned on or off independently of each other.

Since the Frankfort exposition in 1891, a large number of alternating-current stations have been built on the European continent. Some of the older ones, as Cologne and Amsterdam, supply each consumer with an individual transformer; the secondary voltage is 72. An intermediate terminal on the transformer allows of the use of single lamps at 36 volts. Most of the stations built later connect the lamps with a network of secondary mains fed from a transformer station. The voltage is 110 or 120, so that three lamps can be connected in series with a suitable choking coil, which takes the place of the ohmic resistance of the direct-current lamp. Quite recently the Avenue de l'Opera in Paris has been again lighted with alternating-current lamps. The first attempt was made in 1878, with Jablochkoff candles, but since 1882 the street was lighted with gas. The primary current is stepped down to 2:0 volts. Two transformers are used, each supplying five circuits. Five lamps are connected in series on one circuit, requiring $5 \times 36 = 180$ volts. The choking coil for five lamps requires 20 volts. A drop of 20 volts in the line is allowed, which makes a total of 220. After midnight the illumination is reduced by disconnecting the transformer from the 12 o'clock circuits.

These examples serve to show that alternating arc lighting is in vogue on the European continent. Various attempts have been made to run a large number of alternating arc lamps in series from a constant-current dynamo with varying voltage, or they have been connected with a constant-current transformer. Other methods for alternating series arc lighting have been proposed and tried; none, however, have come into extensive use. The difficulties in high-tension series alternating lighting arise in the lamps which are not yet satisfactory. They have been overcome in England by rectifying the negative waves of the alternating current. The current from the constant-potential alternator is led to a constant-current transformer. This consists of movable primary coils and fixed secondaries. The force of repulsion between primary and secondary is balanced by adjustable weights. The regulation is dependent upon the leakage in the transformer. The current is brought from the converter to the rectifier proper, which is a revolving commutator driven by a synchronous motor. The pulsating direct current is sent from here into the line. The crater is formed at the positive carbon; the light is consequently thrown downwards, just as in a direct-current lamp. A rectifier set requires but small floor space and very little attendance. The wear of the brushes on the commutator is said to be not worse than on arc machines. The efficiency of a 40-light set is about 81 per cent. The rectifier system fills a long-felt want in England, as is amply demonstrated by its rapid introduction. The latest type of Ferranti apparatus has a capacity of fifty 12-ampere lamps. These are the systems which at present are used in America and Europe for the distribution of electrical energy for arc lighting.

In taking up the final conversion into light, we will compare European with American lamps. Gravity feed is nowadays used everywhere; the mechanical means for accomplishing the feed, however, differ greatly from each other. The clutch and rod is the American standard; the clutch or brake wheel, in connection with a gear and a rack rod, the English; the rack, the chain or ribbon in connection with a train of wheels, the standard on the continent of Europe. The arc in American lamps is mostly traveling. The interior of the globe, the lower carbon holder and the lamp rod are not protected against the weather. With these concessions, a greater simplicity has been obtained than in foreign lamps, which are mostly of the focusing type and incased. English lamps are very simple in construction; those of the other European countries, however, show strongly the hand of the clockmaker. They are often fitted with contrivances which are easily put out of order and are very delicate. For simplicity, ability to stand wear and tear, quick carboning and cleaning, ease of inspection and repair, quick handling and connecting, the American clutch lamp has not been surpassed.

In England the electrical regulation of the lamp is mostly mechanically differential, while in Germany, as well as in many other countries, the shunt lamp, filled with a shunt magnet, which strikes, regulates and feeds the arc, has displaced the differential type to a great note. Of late, high-tension series arc lamps have come into use in our country which are focusing, incased, of the clutch type, short length, ornamental in their outer appearance and fitted with a single pair of carbons for all-night lighting. Double-carbon lamps are very seldom used at present in new installations; single carbon lamps, with five-eighth-inch carbons and the necessary length for all-night lighting, take their place. Double-carbon focusing lamps are used in England; five-eighth-inch or eleventh-sixteenth-inch carbons are used for all-night lighting elsewhere in Europe.

Very little need be said about the European solid and cored carbons. They are used extensively here and are well known. The purpose of the core is to anchor the arc and keep it from wandering about, which results when the section of the carbon is too large in proportion to the current. The core decreases the resistance of the arc by the higher conductivity of the vaporated material, and allows a lower voltage. Coated carbons are unknown abroad, and at present are used here less than heretofore. Their use was justified in the earlier days, when the resistance of the carbons was high and their life short. The thin coat of copper which surrounds the lower part of the peak of the negative carbon, where the temperature is not high enough to melt it

very readily, intercepts a good deal of the light. The molten globules of copper which drop on the glass globe and adhere to it account to some degree for the breakage of the thus disfigured globes. It is just as important to use good carbons, and of the proper size, as it is to employ efficient machinery. Else the advantages gained by one are offset by the disadvantages of the other.

To the progress in the manufacture of carbons is due the perfection of the long-burning arc lamps with inclosed arc. The arc in these lamps is surrounded with a small glass globe, which is closed air-tight at the bottom. At the top it is closed in such a manner as to allow the passing through of the positive carbon, the escapement of the products of combustion and the entering of fresh air. The oxygen of the air combines with the free carbon to CO_2 and CO, and prevents its deposit and blackening of the globe. The lamp, which has become standard in the United States—abroad it is hardly in use at present—consumes 4.5 to 5 amperes at a pressure of 110 volts. The arc voltage is about 80; the balance is taken up in a resistance which serves for the steadying of the arc. Aside from the great saving in carbons and attendance, these lamps have the advantage that they can be connected singly with a 110-volt circuit, whereas, thus far, constant-potential arc lamps had to be run in pairs on 110-volt circuits. Long-life arc lamps require, when run singly, only a simple mechanism; with a main circuit magnet they are perfect spark arresters. The double globes, with which the lamps are fitted, diffuse the light very evenly when properly selected.

Clear glass globes for street lighting are solely used in America, while abroad, diffusing (opalescent, opaline, alabastrine) globes are used. European critics who usually describe these clear globes as a mere protection against the weather, have often made them the target of their sarcastic remarks, and have blamed the American public for the poor protection they afford the eye. Of late, however, opalescent globes have come into use. Different attempts have been made to reduce the loss in light produced by the use of the diffusing globes in outside service and to gain a better distribution. Although these attempts are old, it is only since a short time that they have reappeared again, greatly improved and modified, in France in the holophane or entirely luminous globes. The outer surface of these clear, transparent globes is covered with a large number of very small, horizontal ribs and groovings (prisms). They have two faces, one reflecting and the other refracting, and spread the light vertically. The shape of these prisms is different, according to their relative position to the light. The inner surface of the globes is covered with a large number of vertical flutes, which spread the light horizontally. The flutes are concave at the bottom and separated by narrow ribs. The loss in light is very small compared with other diffusing globes, and the light is better distributed. Holophane globes are expensive at present, are difficult to clean, are split in two halves, and require special fittings for their support.

Two part globes are sometimes used in France where for street lighting the harp and hood is in very extensive use for the rigid support of lamps on posts. Quite sharply marked from this is the German method, which supports street lamps on a so-called bishop's crook—a straight ornamental stem with a crook at the end—in such a manner that they can be lowered for the trimming. This avoids the use of a ladder or of steps on the post, but the line wires hang flopping about, which does not add to the beauty of the post or to the insulation resistance of the net. Where high voltages are used lamps are rigidly supported on the post and carefully insulated from the ground. The American hood, with its wooden hangerboard and post, answers these requirements. Since the voltage on arc circuits has in late years been nearly doubled, the hangerboard and hood have been discarded with, the outside exposed binding posts of the lamp located in the inside, the weatherproof lamp is insulated suspended on the post.

Arc lighting is by far not in as general use as it is here. Public street lighting is very often confined to the main thoroughfares. The conditions under which arc lighting developed in America and Europe differ greatly, and the results are a consequence of these varying conditions. On both hemispheres the effort has been made to advance the development of arc lighting, further its progress and make it an important link in the chain which drives the world's restless machinery.

An Attractive Electrical Advertising Apparatus.

The amount of current annually consumed and paid for by the larger retail stores, hotels, theaters, etc., in their illuminated advertising signs, would probably keep a good-sized town in store and residence lighting for quite a while. When it is remembered that the average street sign, now in such universal use, will cost about $1 per lamp to construct and wire, and that it will average at least 15 lamps per letter, one will not be surprised at the cost of maintaining, for instance, the sign, "Electrical Review," in front of the Times Building 365 nights per year. To meet a demand for a somewhat cheaper and, at the same time, highly attractive advertising device, the Chicago Edison Company has placed on the market a sign which, it is claimed, is not only cheap to construct, but very economical in the use of current, and, at the same time, fully as efficient, or perhaps more so, in attracting the passer's attention, as a stationary one. Our illustration shows the device complete. The six-sided revolving lantern is mounted on a horizontal stationary shaft, on which are fastened twelve 16-candle-power lamps. A reflector mounted immediately behind the lamps throws a powerful light on each of the six lettered panels, as it slowly passes before them. The lantern is driven by a one-eighth-horse-power motor through a compound worm gear, at a speed of three revolutions per minute. The sign is extremely attractive, and will no doubt meet with a ready sale.

An Attractive Electrical Advertising Apparatus.

American Institute Fair.

The directors of the American Institute are actively preparing for what they mean to be the best show ever given by their institution. The next fair, which will be the sixty-sixth, will be held at Madison Square Garden. It will continue for six weeks. The dates are Monday, September 20, to Thursday, November 4, inclusive.

Competitive exhibits on a grand scale of penmanship and drawing from public school pupils is a contemplated phase of the fair, which will be strictly in line with the traditions and undeviating aim of the American Institute to be a public educational institution of increasing value.

Electric Storage Battery Company.

The report of the Electric Storage Battery Company, of Philadelphia, for the year ending December 31, shows that the gross sales were $646,318; expenses, $504,320; net, $141,998; net income, $148,799; interest, $13,737; net profit, $135,062; gross increase, $318,087, or 97 per cent; net profit increase, $132,079.

A cable dispatch from Tegucigalpa, Honduras, states that the congress of that country will grant to a syndicate of Washington capitalists a concession to build an electric railroad from Puerto Cortez to Truxillo.

KIND WORDS.

A SPLENDID JOURNAL.

To the Editor of Electrical Review:

It is with pleasure that I inclose check for renewal of subscription to your splendid journal.

Yours very truly,
George W. Beers.

April 26.

Milwaukee Industrial Exhibition.

The sixteenth annual exhibition of the Milwaukee Industrial Association will open at Milwaukee, Wis., on Saturday, September 4, and close on October 9. No charges for space, light, power, gas or water are made to exhibitors. Mr. A. Trumpff is the secretary and manager of the association.

ELECTRIC LIGHT FLASHES.

The power house of the city gas and electric plant of Trenton, Mo., has been destroyed by fire, at a total loss of $10,000.

It is said to be probable that the terms of the members of the Board of Electrical Control of New York city, which expire by law on November 1, 1897, will be extended to November 1, 1898.

The City Council of Los Angeles, Cal., has declared by ordinance that all wires in the business part of the city, except for electric railways and lights, shall be placed under ground within one year from April 1, 1897.

E. Wilkinson got a verdict of $2,626.83 in his suit against the Suffolk, Va., Light and Water Company, which he contended owed him $7,500 on account of salary and the furnishing of supplies and materials.

William H. Langley has brought suit against the Denver, Colo., Consolidated Electric Company for $5,000 damages. In attempting to light an incandescent light he placed his hands on an alleged unprotected wire and was badly burned.

The stockholders of the Edison Electric Illuminating Company of Boston subscribed for practically all of the 3,240 shares offered them at $120 per share, though, to be more exact, all the stock was subscribed for with the exception of two shares. The right to subscribe expired at the close of business, April 26.

The Oxford, Me., Light Company, which is the new corporate name of the Norway Electric Light Company, has recently negotiated a mortgage on their plant at Norway for $80,000. The Union Safe Deposit and Trust Company, of Portland, is named as trustee. The bonds are of $1,000 denomination, 20 years, five per cent.

W. A. Campbell, of St. Paul, Minn., whose filings on the waters of Lytle Creek, near San Bernardino, Cal., was mentioned in the Review a few weeks since, has organized a company, capital stock, $300,000, all of which has been subscribed, and the work of developing power for electrical purposes has actually commenced. The capacity of the plant will be 1,500 to 2,000 horse-power.

The legislature has just passed the bill which grants a charter to the Columbia Electric Power Company, of Valatie, N. Y. The plan of the company is to establish reservoirs along the line of the Kinderhook Creek to compound the water during the seasons of excessive flow. There will be three large reservoirs constructed—one at Valatie, one at Stuyvesant Falls, and a third at Rossman's. The Valatie reservoir will back water a distance of three miles and cover about 1,000 acres of land. Numerous small dams will also be erected at other points on the creek to hold the water in reserve. Electricity will be transmitted for light, heat and power to a distance of 60 miles. Two conditional contracts have already been made in a city 40 miles distant. It is now anticipated that about 100,000 horse power can be developed.

General Electric Company's Fifth Annual Report.

Below will be found the fifth annual report of the General Electric Company as of January 31, 1897. The annual meeting of the company will be held at Schenectady, N. Y., on May 11, at noon, to elect 13 directors and transact other business.

SCHENECTADY, N. Y., April 27, 1897.

TO THE STOCKHOLDERS OF THE GENERAL ELECTRIC COMPANY:

The business of your company has suffered during the past year, in common with that of all manufacturing enterprises, from the disturbed financial and political conditions which have prevailed during a considerable portion of the time. These conditions have curtailed the amount of capital ordinarily available for the establishment and extension of power and lighting plants, and have enforced the practice of great economy on the part of its customers. As a result, the shrinkage in orders received by your company was very marked, especially during the latter half of the year. This shrinkage is not shown by a material falling off in shipments, as given in the profit and loss statement on page 17 of this report, but the amount of work in progress and unfilled orders on hand is considerably less than a year ago.

With a return to normal commercial conditions a corresponding revival in the business of your company may be expected. The volume of business secured by it for the first three months of the current year is slightly in excess of that for the same period in either of the three previous years.

On January 31, 1895, the sum of $2,000,000 was set aside, as shown in the annual report of that year, to provide for shrinkage in assets, exact values of which it was then extremely difficult to fix. During the past year your directors have been able to value these items with substantial accuracy, and the $2,000,000 fund has been found sufficient and has been used to provide for the proper adjustment of all accounts and other assets for which it was created.

BUSINESS OF THE YEAR.

Gross earnings	$12,820,395 87	
Less expenses	11,207,388 65	
		$1,613,007 22
Deduct.		
Interest on debentures*	$431,250 00	
Less interest and discount, and interest and dividends received on securities owned	370,479 70	
		60,770 30
		$1,552,236 92
Deduct amounts written off:		
Sundry losses and allowances for possible losses	$318,531 13	
Patents	349,919 20	
Inventories and consignments	61,084 36	
	$729,534 69	
Less.		
Profit on securities sold and debentures canceled	136,955 85	
		592,578 84
Reduction of the deficit of previous years		$959,658 08

Additional purchases of your company's debenture bonds have been made during the year to the amount of $750,000, leaving now outstanding $8,000,000. All debentures purchased have been canceled.

The decrease in the amount of interest and dividends received as compared with the previous year, is due largely to the cessation of dividends by the Canadian company, which it is hoped will soon resume dividends on its reduced capital. As a partial offset, there has been an increase in the income derived by your company from dividends on stocks held by it in various local companies.

*On $8,750,000 for 10 months, and on $8,000,000 for two months.

Patent Licenses and Patent Litigation—In the last annual report, attention was called to an arrangement which had then been concluded with the Westinghouse Electric and Manufacturing Company for an exchange of licenses under patents owned and controlled by the two companies. Your directors are pleased to report that the result of this arrangement has been highly satisfactory.

The result of the work of your company in protecting its patents and enjoining infringers thereof has been especially encouraging, and a considerable number of patents of value has been acquired by it during the year. The courts have invariably recognized the validity and controlling importance of the Van Depoele patents on the electric railway trolley and switch system, and at the present time substantially all manufacturers of infringing trolleys and switches are under injunction. The company has met with no reverses in its patent litigation during the past year.

Many new suits have been brought, involving important patents, and are now being actively pushed.

Sales, Financial and Manufacturing Departments—Attention is called to the reports of the first, second and third vice-presidents, containing much valuable information with respect to their various departments.

The great improvements made by your company during the past year in the design and construction of its apparatus have been very satisfactory. The development in long-distance transmission of electricity and the progress made in electric railway service have been especially noteworthy. Many new enterprises, involving the application of electricity to railways now operated by steam, are under consideration, and the ensuing year promises to be marked by a very rapid growth in that field of work.

Your company has added one large factory of brick and steel construction to its plant in Schenectady during the year, besides completing and occupying another, which was commenced in 1895. Other important improvements at these works are in preparation, designed to add to the facility and economy of handling their output.

By order of the board of directors.
C. A. COFFIN, President.

REPORT OF SECOND VICE-PRESIDENT.

SCHENECTADY, N. Y., April 27, 1897.

C. A. COFFIN, ESQ., President.

The balance sheet and statement of profit and loss, herewith transmitted, include the assets and liabilities and profit and loss accounts of the Edison General Electric, Edison Electric Light and Thomson-Houston Electric Light companies (which, for convenience of book-keeping, are consolidated with those of the General Electric Company) at January 31, 1897; and when "the company" is spoken of, all the above-mentioned corporations are included.

I submit explanations of what each item on the balance sheet represents.

Assets: Patents and Franchises—During the year there was expended for acquiring new patents and patent litigation, $349,919.20, all of which has been written off to profit and loss, leaving the patents, franchises, good-will, etc., of the company standing unchanged at $8,000,000.

Factory Plants—This account represents the real estate (lands and buildings); machinery, tools, appliances, etc.; patterns, drawings, etc., and sundries (fittings and other small property accounts) of the factories at Schenectady, N. Y.; Lynn, Mass., and Harrison, N. J.

The lands amount to over 72 acres, and the total factory floor space of all buildings is approximately 1,416,000 square feet.

All are free from mortgage or other lien.

These plants being a permanent investment, all expenditures for their maintenance and repair, plus an allowance to provide against depreciation, are charged to operating expenses.

Their book value, at the date of the last annual report, was $3,468,002. The amount written off during the fiscal year for depreciation, over and above the total cost of all maintenance, repairs and additions, was $68,000, leaving the book value of factory plants at January 31, 1897, $3,400,002.

A summary of the changes in this account during the past year is as follows:

	Book Value Jan. 31, 1896.	Cost of additions.	Written off for depreciation.	Book Value Jan. 31, 1897.
Real estate	$1,800,000 00	$22,092 45*	$97,092 45	$1,795,000 00
Machinery	1,668,000 00	205,321 90	268,321 90	1,605,000 00
Patterns	1 00	47,794 34	47,794 34	1 00
Sundries†	1 00	34,361 68	34,361 68	1 00
Totals	$3,468,002 00	$309,570 37	$447,570 37	$3,400,002 00

* Includes $67,250, cost of building a new erecting and testing shop, 92 by 350 feet, with an annex 60 by 80 feet, at Schenectady.

† Includes office furniture and fixtures, horses and trucks, shop fixtures, benches, steam-fitting for heating system, sprinkler system for fire protection, electric wiring of buildings, etc.

Factories.	Book Value of Each Plant.	
	Jan. 31, 1896.	Jan. 31, 1897.
Schenectady	$2,135,000 90	$2,157,000 90
Lynn	1,038,000 80	993,000 80
Harrison	295,000 30	250,000 30
Totals	$3,468,002 00	$3,400,002 00

Real Estate (other than factory plants)—This account represents the investment in the Edison Building, 44 Broad street, New York city, also a large building covering five lots on the corner of Avenue B and Seventeenth street, New York city, and sundry parcels of land in various places, mostly improved and rented, which have been acquired at various times, chiefly in payment of debts.

All will be sold when opportunity offers.

Stocks and Bonds—Schedule A annexed hereto contains a list of nearly all the company's stocks and bonds which are carried at more than merely nominal values.

Those having a market value are carried at slightly under the price of recent sales. The book value of those not readily salable has been fixed after careful examination of their present worth.

I believe their actual present value is equal to the aggregate at which they stand in the balance sheet; viz. $8,545,660 68

In addition, the company owns various miscellaneous securities of many manufacturing, selling and patent-owning corporations, and also of street railway and lighting companies. As the present value of these is doubtful, and their future value speculative, they are carried at one dollar for each lot, making in all 135 00

Total book value of all stocks and bonds	$8,545,795 68
The book value of stocks and bonds in the last annual report was	5,479,332 23
Increase	$3,066,463 45

Although some securities have been purchased for cash, most of those acquired during the year have been accepted in payment of *old* indebtedness.

The principal items of the above increase are:

	Par Value.
Edison Electric Co. of New Orleans. Received in exchange for the claim against the receivers of the Fort Wayne Electric Co., and for cash advanced to the Edison Electric Co. to purchase the Louisiana Electric Light Co. and build a large, new central light and power station:	
First mortgage bonds	$891,000
Preferred stock	1,980,000
Common "	1,000,000
B. & O. Railroad Co.'s receivers' certificates, received in payment of balance due for electric plant and electric locomotives for its tunnel under the city of Baltimore	323,000
Bonds of the city of Jacksonville, Fla., received in part payment of a lighting plant	58,000
Sacramento Electric Power and Light Co., received in part payment of a contract	44,000
Bonds of the Brush Electric Co. (the entire issue outstanding), received in payment of notes and purchased for cash	369,000
Bonds of the Columbus R. R. Co., Columbus, Ga., received in payment of claim against Brush E. L. and P. Co., of Columbus	50,000
Preferred stock of the United Electric Securities Co., bought for cash	74,200
Bonds of the Citizens' General Electric Co. of Louisville, Ky., purchased.	94,000
Bonds of the Tacoma Ry. and Motor Co., purchased under old contracts with the United Electric Securities Co	231,000
Bonds of the Augusta Ry. and Electric Co., received in exchange for claims against Thomson-Houston Electric Co., of Augusta, Ga	41,000
Stocks and bonds received from licenses in payment of royalties	119,750
	$5,274,950

Sales of Stocks and Bonds—The past year has not been favorable to the established policy of selling securities which there is no special reason for holding permanently, and but few have been sold since the last annual report.

Securities whose par was $326,115 were sold for	$285,829 56
They were carried on the books at	206,012 80
Profit	$79,816 76

The cash thus received was used toward the purchase of securities mentioned on the preceding page.

Cash—The policy of the previous two years has been adhered to, and sales maintained on a basis of cash or short credit to desirable customers.

It has not been necessary to borrow money, nor has the company's credit

been used during the year, either by issuing notes, indorsing customers' paper for discount, or lending its name in any way.

During the year all purchases have been paid for in cash.

None of the money realized from the sale of assets was required for the current business of the company during the year.

Notes and Accounts Receivable—These accounts represent the total amount now due the company by customers.

They appear in the balance sheet at an estimated realizable value (i. e., their face, less allowance for possible losses), which I believe to be a fair one.

They may be classified approximately as follows:

	Face Values.	Face Values.
Cur. notes	$1,196,715 81	
Cur. acc'ts	2,901,773 96	
		$4,098,489 77
Slow notes	766,974 05	
Slow acct's	207,188 16	
		974,162 21
		$5,072,651 98
Due from local lighting and street railway properties owned by the company		217,700 92
Due from the Brush Electric Company		194,516 85
Total face value*		$5,484,869 75

Collection of the old indebtedness remaining from previous years has been as satisfactory as was possible under the financial conditions of the year.

Work in Progress—This account does not include anything in process of manufacture, but represents expenditures for labor, material, etc., on 194 installations of manufactured apparatus delivered at various places $900,807 52

Less partial payments thereon, received under the terms of the contracts as work progressed 382,941 22

Balance $517,866 30

None of the estimated profit to be derived from these installations is included in the earnings of the year, and no allowance is made thereon for possible loss.

Inventories—These accounts represent raw materials and goods manufactured and in process of manufacture at the factories; manufactured goods in storerooms of local offices and on consignment; office furniture, fixtures, instruments, etc., in the general office and in local offices; tools and materials in local repair shops, and also shipments in transit to local storerooms.

All have been counted and valued item by item.

Raw materials have been valued at the market prices prevailing on January 31, 1897; active selling finished and partly finished apparatus and supplies at factory cost; inactive or slow-selling apparatus and supplies at about 50 per cent of factory cost; obsolete apparatus and supplies at scrap value, and tools, instruments, furniture, etc., at present value.

The inventories of the factories showed an excess over book value of $141,184.98, which is not taken as a part of the year's profit, but is retained as a reserve.

All other inventories showed a shrinkage from book value of $50,354.85, which has been written off as a loss for the year.

As goods are taken in and out of local office inventories at factory cost, at the time being, the bulk of the above shrinkage is due to factory costs at January 31, 1897, being lower than at January 31, 1896, and the remainder to writing down the book value of slow-selling apparatus and other personal property.

*In addition, there are old notes and accounts receivable of 435 debtors, aggregating $2,644,547.59, which have all been written off to profit and loss, except the nominal book value of one dollar for each debtor. They are being liquidated as rapidly as possible.

Consignments—Finished apparatus for novel uses has been delivered to various concerns, subject to purchase if its operation is successful. The greater part of this account represents such contingent sales, and the remainder represents apparatus on exhibition, or loaned to regular customers for temporary use by them.

All the above apparatus is charged, at factory cost, to this account at a total of	$73,729 80
Less allowance for depreciation	35,977 15
Net book value of consignments	$37,752 65

Liabilities—The company has no notes payable, nor is any paper bearing the company's indorsement or guaranty under discount.

Debentures—During the year the company has purchased and canceled $750,000 of its own debentures at an average cost of 92.38 per cent.

Accrued Interest on Debentures—This account, as its name implies, is the full amount of interest accrued to January 31, 1897, on the company's $8,000,000 outstanding five per cent gold coupon debentures.

Accounts Payable—This account includes all unpaid audited indebtedness.

At the close of business on January 31, 1897, the unpaid vouchers on hand amounted to only $40,155.32, and none of these was due under the terms of purchase.

The difference between that amount and the amount of accounts payable—shown in the balance sheet—$402,264.81 represents expenditures belonging to the year, vouchered between January 31 and February 23, the date of closing the general books. The amount of vouchers which have to be carried over in this way monthly, owing to keeping the books—other than the cash book—open a sufficient time to include expenditures of a particular month in that month, is usually about $500,000.

Mortgage on Edison Building—A mortgage, created when the company's building, No. 44 Broad street, New York city, was erected. It was paid off in full February 26, 1897.

Respectfully submitted,
J. P. ORD,
Second Vice-President.

The report concludes with a list of stocks and bonds owned by the company, aggregating $15,427,259. These are classified as stocks of a par value of $8,689,260, bonds of a par value of $6,384,974, and miscellaneous stocks and bonds amounting to $353,025.

Owing to the absence in Europe of the first and third vice-presidents of the company, their statements were not prepared in time to be included in the report. They will be issued later.

CONSOLIDATED BALANCE SHEET OF JANUARY 31, 1897.

ASSETS.			LIABILITIES.		
Patents and franchises		$8,000,000 00	Capital stock:		
Factory plants		8,400,002 00	Common	$30,460,000 00	
Real estate (other than factory plants):			Preferred	4,252,000 00	
Edison building, New York city	$412,584 63				$34,712,000 00
Other real estate	230,431 61		5% Gold coupon debentures		8,000,000 00
		643,016 24	Accrued interest on debentures	66,666 65	
Stocks and bonds		8,545,795 68	Accounts payable	402,264 81	
Cash		703,483 84	Mortgage on Edison Building	200,000 00*	
Notes and accounts receivable	$4,578,600 96				668,931 46
Work in progress	517,866 30				
	$5,096,467 26				
Inventories:					
Factories	$3,375,511 07				
General and local offices	621,489 32				
Consignments	37,752 65				
	4,034,753 04				
		9,131,220 30			
Profit and loss		12,957,413 40			
		$43,380,931 46			$43,380,931 46

* Paid off February 26, 1897.

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JANUARY 31, 1897.

EXPENSES.			EARNINGS.		
Balance, January 31, 1896		$13,917,071 48	Sales	$12,540,993 88	
Cost of goods sold	$9,691,501 12		Royalties and sundry profits	279,401 99	
General expenses and taxes	1,515,887 53				$12,820,395 87
		11,207,388 65	Dividends and interest received on stocks and bonds owned	282,143 69	
Interest on debentures		431,350 00	Interest and discount	88,336 01	
Sundry losses and allowances for losses	318,531 13				370,479 70
Depreciation of inventories	50,354 85		Profit on sales of stocks and bonds	79,816 76	
Depreciation of consignments	10,729 51		Discount on debentures purchased and canceled	57,139 09	
		379,615 49			136,955 85
Patents and patent expenses		349,919 20	Balance, January 31, 1897		12,957,413 40
		$26,285,244 82			$26,285,244 82

E. & O. E.
J. P. ORD, Second Vice-President.

A Milwaukee Removal.

The Wisconsin Electrical Construction Company, Milwaukee, has decided to make a change of location, and about August 1 next will move diagonally across the street to Nos. 460, 462, 464 Broadway, where a suitable three-story building is being erected for them. The building will be modern in every sense of the word and designed especially for the company's growing business. The company will also engage in the manufacture of several specialties in its line. The lower floor of the new building will be devoted to the offices, freight and shipping rooms and repair shop; the second floor will be given up to the factory proper, while on the upper floor will be displayed the most complete line of electric, combination and gas fixtures, as well as artistic candelabra, in the northwest.

TELEPHONE NEWS AND COMMENT.

The Southern Bell Telephone Company, at Staunton, Va., has reduced its rates to $6 per year, the rate to go into effect if a sufficiently large number of subscribers can be secured to justify the reduction.

The Erie Telegraph and Telephone Company has declared dividend No. 54 of one per cent, payable May 17, to stockholders of record May 8. On account of the dividend and the annual meeting, the stock books will be closed on May 8 and opened on June 9.

The Empire State Telephone and Telegraph Company's building, at Seneca Falls, N. Y., was gutted by fire on April 28. John Stahlnecker, 26 years old, who lived with his parents overhead, was burned to death, and his father and sister barely escaped with their lives. The loss is about $1,000.

The annual report of the New England Telephone and Telegraph Company, as of December 31, compares as follows:

	1896.	1895.	Increase.
Gross	$2,708,652	$2,430,102	$278,550
Operating expenses	2,175,717	1,872,328	303,389
Net	$604,934	$557,773	$47,161
Dividends	508,180	457,362	50,818
			Decrease.
Surplus	$96,754	$100,414	$3,660

Western Union officials laugh at the report that the Bell Telephone and Postal Telegraph companies will combine. They say that, in their opinion, the Bell Telephone Company would not dare to take any such steps. The harmony heretofore existing between the Western Union and Bell companies is, in the opinion of Western Union authorities, really essential to the well being of the telephone company. —*Boston News Bureau.*

The board of education of Kansas City, Mo., has made a contract with the Missouri & Kansas Telephone Company for telephone service in all the public schools. A switchboard will be placed in the secretary's office, and private lines run to all the school buildings. This service was decided upon by the board for sake of convenience and for use in case of fire in any of the school buildings, or to give the alarm to the teachers if a heavy storm be approaching.

The instrument statement of the American Bell Telephone Company for the month ended April 20 shows: Gross output, 20,426 against 21,525 last year; returned, 7,245 against 6,330; net output, 13,181 against 15,195. Since December 20: Gross output, 73,735 against 76,518; returned, 28,156 against 28,462; net output, 45,559 against 47,056. Total telephones outstanding, 819,428 against 724,592. The April, 1896, output was the biggest month's output in the history of the Bell company.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

COALVILLE, UTAH—Telephone connection between this place and Park City will be made within a month. The route of the line will embrace Coalville, Hoytsville, Wanship, Rockport, Peoa, Oakley, Kamas and Park City.

MARION, OHIO—The Marion Telephone Company has been incorporated. The capital stock is $40,000. The plant will be built at once. Charles D. Juvinall, S. M. Heller, M. Donnelly, E. Huber, James F. Prendergast, O. Wollenweber, J. A. Schroeter, J. J. Hopkins and Fred E. Guthery, incorporators.

REDKEY, IND.—A first-class telephone service is to be put in by the Central Union Telephone Company.

PORT ARTHUR, ONT.—The Bell Telephone Company has instituted an all-night and Sunday service in this place. The council voted $50 to further the scheme.

PORT ARTHUR, TEX.—The Port Arthur Telephone Electric Company has been incorporated by R. H. Woodworth, F. Dumont Smith and George E. Blaine. Capital stock, $50,000.

WEBSTER, N. C.—The Webster & Dillsboro Telephone Company is extending its telephone lines.

STAUNTON, VA.—The Staunton Mutual Telephone Company has been incorporated with William Patrick, president; N. C. Watts, secretary and treasurer, to establish a telephone system.

DETROIT, MICH.—The Valley Telephone Company has been incorporated for the purpose of constructing and operating a telephone system in Saginaw, Bay City, West Bay City and the surrounding country. The company is capitalized for $300,000, has already secured about 1,000 telephone contracts in the cities named, and intends to push the work of construction rapidly under the franchises granted by the three towns.

REDDING, CAL.—The Sunset Telephone and Telegraph Company has completed the line between this city and Red Bluff as far as Cottonwood, and communication has been established with the last-named place. The line will probably be completed to Red Bluff this week.

GLENS FALLS, N. Y.—The Hudson River Telephone Company intends making extensive improvements this Spring, putting in higher poles, etc.

WALDECK, TEX.—A telephone line is being constructed and will be completed between this place and Walhalla.

STILLWATER, MINN.—The American Telephone and Telegraph Company has been granted right to operate lines in this city.

MANKATO, MINN. — The Northwestern Telephone Exchange has made three extensions to their system. One is to follow the Milwaukee road to Wells, and thence to Albert Lea. The second is to go to Rochester, and the third to New Ulm. This company expects to cover southern Minnesota with a network of wires in the near future.—The North Central Telephone Company, which has an exchange in Waterville and a franchise in this city, is taking preliminary steps to connect the towns.—The Blue Earth Valley Telephone Exchange Company, which has reached this city on its way north, is arranging to extend on to the twin cities.

SALTILLO, TENN.—The Saltillo & Decaturville Telephone Company has been incorporated.

CLIFTON FORGE, VA.—N. C. Watts, of Clifton Forge, and J. A. Sproul, of Augusta, Ga., have commenced work on the construction of a telephone system.

NEWPORT NEWS, VA.—The Citizens' Telephone and Telegraph Company has been granted franchise to construct a telephone system.

SPARTANSBURG, S. C.—The Spartansburg Telephone Company has been incorporated by Albert H. Twitchell, D. E. Converse, John H. Montgomery, H. E. Heinitsh and others. Capital stock, $10,000.

WEST SUPERIOR, WIS.—A franchise has been granted for a term of 30 years to the People's Telephone Company, the consideration being a big reduction in rates from the present tolls.

Electric Light and Power.

CHARDON, OHIO—An electric light plant is to be established here.

JONESBORO, TENN. — An electric light plant is to be erected at this place within a short time.

SCOTTSBURG, IND.—This city is to have electric lights, a franchise for 10 years having been granted to a private company from Louisville.

NEW CASTLE, DEL.—New Castle Jail will be lighted by electricity after May 1.

REVERE, MASS.—The contract for wiring the bathhouse and parkway of the Revere Beach Reservation for the electric lighting system has been awarded to J. S. Potter.

DELTA, COLO.—An electric light plant is to be established here.

PIERRE, S.D.—Articles of incorporation have been filed for the Bowdle Electric Light Company, with a capital of $5,000. Incorporators, H. D. Baillet, W. W. Brant, A. F. LeClaire, A. L. Yeaton.

SAN FRANCISCO, CAL.—The Bay City Electric Light and Power Company has been incorporated by Louis de Roome, Henry C. Knowles, G. W. West, Frederick Miller and William F. Gibson. The capital stock is $750,000, of which $250 has been subscribed.

WESSON, MISS.—The Wesson Mill and Improvement Company contemplates the erection of an electric light plant. It desires estimates on same.

EASTMAN, GA.—The Eastman Electric Light and Telephone Company—W. N. Leitch, F. B. Stubbs, J. B. Caldwell and others—have obtained franchise for lighting and contracted for erection of plant.

NEVADA, MO.—H. C. Moore has been granted franchise for electric lighting.

TOCCOA, GA.—The Southern Industrial and Colonization Society has been granted charter for electric light plants.

BOWDLE, S. D.—The Bowdle Electric Light Company has been incorporated by H. D. Baillet, W. W. Brant, A. F. LeClaire and A. L. Yeaton. Capital stock, $5,000.

CAMDEN, S. C.—S. Logan Lang desires estimates and proposals on electrical machinery to convert 15,000 horse-power into electricity and convey it five miles.

SILOAM SPRINGS, ARK.—W. H. Daney, Secretary, may be addressed concerning construction of electric light plant.

SAVANNAH, GA.—The Edison Electric Illuminating Company—George J. Baldwin, Charles A. Stone and Edwin S. Webster—have applied for incorporation to build a plant for supplying electric light and power. Capital stock, $100,000.

GRAND FORKS, N. D.—City Clerk may be addressed concerning construction of a new electric light plant, to cost $21,000.

MORRIS, MINN.—Wells Brothers & Hanson will light their store by electricity.

PARK RAPIDS, MINN.—Geo. Mandigo is interested in the establishment of an electric light plant.

FISHER, MINN.—An electric light and telephone system will be established at Fertile.

HOLLY SPRINGS, MISS.—Walter G. Kirkpatrick, of Nashville, Tenn., and Canton, Miss., has been engaged to prepare plans and specifications for the proposed waterworks and electric light plant.

IRVINGTON, IND. — Town Clerk may be addressed concerning electric light plant.

WORCESTER, MASS. — The Washburn & Moen company will shortly commence work on the laying of the underground wires of the Electric Light Company. The cost of the wire and conduits will be about $100,000.

SAVANNAH, GA.—City Clerk may give information concerning electric light plant.

ROCK RAPIDS, IOWA—A new electric light plant is to be erected.

REDFIELD, S. D.—Work on the electric light plant will shortly commence.

New Electric Railways.

LIBERTY, N. Y.—The Liberty & Jeffersonville, Sullivan County, Electric Railway Company has been incorporated, with a capital of $120,000, to operate a line of railroad between the two places.

RIVERHEAD, N. Y.—Riverhead, Quogue & Southampton Railroad Company has been incorporated to build a street surface electric road six miles long from this place to Quogue, in Suffolk County. Capital, $60,000; and directors, Joseph Martin, J. A. MacElhinny, W. J. Martin, Joseph W. Brooks, of 132 Nassau street; Marks Kaskell, Morris Stamper, Solomon Brooks, Thomas E. Murray and William A. Mass, all of New York.

OAKLAND, CAL.—The San Pablo avenue cable road is to be reconstructed into a modern trolley line, and the route extended from the present terminus at San Pablo avenue and Park street to Emeryville. Work is to be commenced within a fortnight.

TAUNTON, MASS.—The Providence & Taunton Electric Railway Company's directors have petitioned for franchise for road through towns of Seekonk, Rehoboth and Dighton.

WILMINGTON, N. C.—The Wilmington Street Railway Company has been awarded contract for lighting the city. A resolution was adopted looking to the city owning its lighting, water and sewerage systems.

GREENVILLE, S. C.—J. S. Lawrence and others have been granted a 37-year franchise to establish an electric street car system.

BINGHAMTON, N. Y.—The Savona Valley & Lake Keuka Electric Railway Company has been incorporated. The road will cost about $200,000, and will be completed by September 1.

NORTON, R. I.—The Norton & Attleboro electric system will erect new power station at Barrowsville, and four electric roads are projected to meet at this place.

PORTSMOUTH, VA. — The Portsmouth Street Railway will change its motive power to electricity. Contract has been signed.

COHOES, N. Y. — The Hudson Street Railway has been incorporated, with a capital stock of $50,000. The company is to operate the road of the Hudson Electric Railway Company, which was sold under foreclosure, March 7 last.

OBERLIN, OHIO—A franchise has been granted for the proposed extension of the Cleveland & Elyria, Ohio, Street Railway. The new road will enter Oberlin on East College street.

New Manufacturing Companies.

QUINCY, ILL.—The Quincy Surgical and Medical Institute has been incorporated without capital stock, to train nurses and operate a hospital.

SAN FRANCISCO, CAL.—The John L. Klein Electrical Works has been incorporated to manufacture and sell electrical supplies, etc. Directors, John M. Klein, San Rafael; Charles W. Nevin, Harry A. Sayles, John Stone and John W. Felt, San Francisco. Capital stock, $50,000.

GALION, OHIO—The Electric Signal Clock Company has been incorporated by C. A. Allen, O. L. Hayes, A. F. Lowe, J. H. Dull, W. A. Freese, C. E. Auckerman and F. E. Jordan, of Wadsworth. O. L. Hayes is president of the company. The company will manufacture burglar alarms, bells and signal clocks.

Kindred.... ...Interests

The Electric Appliance Company, Chicago, are introducing a new electrical soldering iron, which they are ready to guarantee is an electrical and commercial success. A reliable electrical soldering iron has been a very difficult device to manufacture. The Electric Appliance Company have given their new iron a very extensive test, and stand ready to guarantee the results.

"Fan Motors" is the title of an elegant brochure now being sent out by the Central Electric Company, 173–175 Adams street, Chicago, Ill. It describes a full line of fan motors and ventilating apparatus for direct and alternating currents. From the handsomely illustrated pages of this brochure a selection of an electric fan for any service may be easily and promptly made. The book is one of the handsomest of the season.

The Standard Air-Brake Company, of New York city, has closed contracts with the Dighton, Somerset and Swansea Street Railway Company, of Taunton, Mass., the Commonwealth Avenue Street Railway Company, of Boston, Mass., and through their foreign agents, for air-brakes for the Continent. The company is also supplying to the Pennsylvania State College, Department of Electrical Engineering, for use on its experimental line, which has been built to teach the students practically, a complete working outfit showing the operation of the "Standard" system.

The Victoria Paper Mills Company, of Fulton, N. Y., are making extensive additions and alterations to their plant. One of these additions will make what they term their new mill building No. 3. The walls of this addition are to be of substantial brick construction. The floors are to be carried by steel girders, supported by the side walls and interior steel columns, and the roof, which is to be gravel on plank, will be carried by steel trusses. This will make a neat building, thoroughly fireproof and well adapted to their needs. The contract for furnishing and erecting the steel work has been awarded to the Berlin Iron Bridge Company, of East Berlin, Ct.

The Card Electric Company, of Mansfield, Ohio, inform the ELECTRICAL REVIEW that the Cleveland Ship Building Company have awarded a contract to them for the entire electrical equipment for their new shipbuilding yards and establishment, which will be located at Lorain, Ohio. The electrical apparatus covered in this contract calls for the following: One 100-kilowatt, 240-volt, direct-connected generator, at a speed of 250 revolutions per minute; one 40-kilowatt, 240-volt, belted generator, and 26 motors, varying in size from two up to and including 40 horse-power. These motors are to be used in various departments of the works for driving machinery of different kinds. In this equipment of motors there will be two of 30-horse-power capacity, to be used for operating two large bending rolls, etc., the total equipment aggregating 500 horse-power. The Card Electric Company state that there are only two electrical manufacturers in the United States, besides themselves, that were in position to manufacture and furnish all of the apparatus called for in these specifications, owing to the design and various-sized motors which could be adapted for their special use. This is the largest contract of the kind that has been let by one corporation for a long time.

STYLE "H" BELL.
PIVOTED ARMATURE.
DOUBLE ADJUSTMENT.
RELIABLE RINGER
Send for New Catalogue.
HUEBEL & MANGER,
MANUFACTURERS,
280-90 Graham St BROOKLYN, N. Y.

WHITNEY ELECTRICAL INSTRUMENT CO., MANUFACTURERS OF
High-Grade Electrical Instruments of Every Description.
PENACOOK, N. H., U. S. A.

WRITE FOR PRICES.
THE ORIENT ELECTRICAL CO.
YOUNGSTOWN, OHIO.
MAKERS INCANDESCENT LAMPS.

FOR LIFE, LIGHT AND ECONOMY,
BEACON LAMPS
HAVE NO SUPERIORS!
We make lamps of every description, from 1-3 to 300 c.-p., and guarantee them to give our customers entire satisfaction.
BEACON LAMP CO.
NEW BRUNSWICK, N. J.
Royal Electric Co., Montreal, AGENTS FOR CANADA.

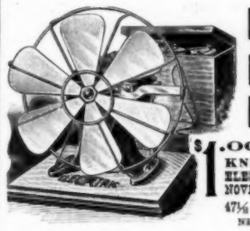
Manufacturers and Dealers PARTRICK & CARTER CO. 125 So. 2nd St. PHILADA. PA. ELECTRICAL HOUSE GOODS.

THOMAS HILL, Jr.,
Experimental Electrical Work AND Electrical Advertising Novelties.
REPAIRING IN ALL ITS BRANCHES.
Special Apparatus Designed and Built.
198 Water Street, New York City.

McINTIRE'S PATENT
CONNECTORS AND TERMINALS.
Special Connectors for HARD-DRAWN COPPER WIRE, All Sizes.
Fused Wire, Fused Links and Strips.
The C. McINTIRE CO., 13 & 15 Franklin Street, Newark, N. J.

W. R. OSTRANDER & CO.,
22 DEY STREET,
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS.
Electric and Mechanical Bells.
FACTORY,
De Kalb Ave., BROOKLYN.
Send for Illustrated Catalogue.

McCASKEY & HOLCOMB COMPANY,
CONTRACTORS
SPRINGFIELD, ILL.
We make a specialty of constructing Municipal Electric Lighting Plants.
Send for Estimates and Valuable Information.


Knapp Battery Motors,
$1.00 UP.
KNAPP ELECTRIC & NOVELTY CO.,
47½ Warren St., NEW YORK.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Rooms 136 and 137, 1 Broadway, NEW YORK.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

ELECTRIC CONDENSERS.
WM. MARSHALL,
Manufacturer.
STANDARDS A SPECIALTY.
709 LEXINGTON AVENUE. NEW YORK.

MECHANICAL DRAWING
Machine Design; Stationary, Locomotive and Marine Engineering; Electricity; Plumbing; Architecture; Architectural Drawing; Railroad, Municipal, 31 COURSES Hydraulic & Bridge Engineering; Surveying and Mapping; Sheet Metal Pattern Cutting; Bookkeeping; Shorthand; English Branches; Mining; Metal Prospecting.
All who study GUARANTEED SUCCESS.
Fees Moderate, Advance or Installments.
Circular Free; State subject you wish to study.
International Correspondence Schools, Box 1003, Scranton, Pa.
TAUGHT BY MAIL

J. G. WHITE & COMPANY,
Incorporated,
ENGINEERS, CONTRACTORS.
Successors to White-Crosby Company, and J. G. White & Co.,
29 BROADWAY, NEW YORK, N. Y.
Baltimore Office, Equitable Building.

Patented.
No. 11, Double Groove Pony Insulator.
HIGH INSULATION.
The most perfect Glass Insulator made is the Teat Insulator.
"The Teats on the lower rim of the petticoat attract the water on the outer and inner surfaces of the Insulator into drops. The water drops from these points on to the cross-arm, thereby preventing the moisture from creeping to the pin."
HEMINGRAY GLASS CO., Covington, Ky.
Factories, MUNCIE, IND.

THE ELECTRICAL MERCANTILE AGENCY.
318 BROADWAY.
Publishers of The Electrical Trades Credit Reference Book.
Containing the names, with capital and credit ratings, of all business houses in the electrical trade in the United States and Canada.
Over 10,000 Correspondents.
Special facilities for prompt collections.
P. M. MOWREY, General Manager.

BUCKEYE INCANDESCENT LAMPS
QUALITY UNEQUALED. FACTORY PRODUCTION TRIPLED.
THE BUCKEYE ELECTRIC CO.,
Monadnock Building, Chicago. - - - - Cleveland, Ohio.

TESLA ON THE HURTFUL ACTIONS OF LENARD AND ROENTGEN TUBES.

(Concluded from page 211.)

Second, there is the purely electrical effect. We have absolute experimental evidence that the particles or rays, to express myself generally, convey an immense amount of electricity, and I have even found a way of how to estimate and measure that amount. Now it is likewise possible that the mere fact of these particles being highly electrified is sufficient to cause the destruction of the tissue. Certainly, on contact with the skin, the electrical charges will be given off, and may give rise to strong and destructive local currents in minute paths of the tissue. Experimental results are in accord with this view, and, in pushing my inquiry in this direction, I have been still more successful than in the first. Yet, while as I have suggested before, this view explains best the action on a sensitive layer, experiment shows that, when the supposed particles traverse a grounded plate, they are not deprived entirely of their electrification, which is not satisfactorily explained.

The *third* effect to be considered is the electro-chemical. The charged particles give rise to an abundant generation of ozone and other gases, and these we know, by experiment, destroy even such a thing as rubber, and are, therefore, the most likely agent in the destruction of the skin, and the evidences are strongest in this direction, since a small layer of a fluid, preventing the contact of gaseous matter with the skin, seems to stop all action.

The *last* effect to be considered is the purely mechanical. It is thinkable that material particles, moving with great speed, may, merely by a mechanical impact and unavoidable heating at such speeds, be sufficient to deteriorate the tissues, and in such a case deeper layers might also be injured, whereas it is very probable that no such thing would occur if any of the former explanations would be found to hold.

Summing up my experimental experiences and the conclusions derived from them, it would seem advisable, first, to abandon the use of bulbs containing platinum; second, to substitute for them a properly constructed Lenard tube, containing pure aluminum only, a tube of this kind having, besides, the advantage that it can be constructed with great mechanical precision, and therefore is capable of producing much sharper impressions; third, to use a protecting screen of aluminum sheet, as suggested, or, instead of this, a wet cloth or a layer of a fluid; fourth, to make the exposures at distances of, at least, 14 inches, and preferably expose longer at a larger distance.

NIKOLA TESLA.

New York, May 1.

W. C. Callaghan, formerly with the Nassau Electric Railroad Company, of Brooklyn, N. Y., has been appointed general superintendent of the Yonkers Electric Railroad, in place of Claude M. Johnson, resigned.

General Electric's Annual Report.

The report of the General Electric Company, for the year ending January 31, was accorded a very flattering reception by Wall street on Friday, the day of its appearance. The surplus earnings, including profits on security sold, after providing interest on the debentures and charging off $729,534 against a similar charge last year of $511,321, were $959,657 against $877,645 for 1895–96. This furnishes unmistakable evidence of an improvement of the general affairs of the company. From the standpoint of the financial community, it is by no means the most significant showing that is made by the report. Time has demonstrated that the policy inaugurated by the bank owners in the days following the 1893 panic is sufficiently comprehensive and possessed of sufficient latitude to enable the corporation to work out its own salvation. It has practically two sources of revenue; namely, its net earnings and the profits which accrue to it through an appreciation in the value in its securities. Earnings promise in time to provide fair returns on the capital investment, while it is likely that the appreciation in the value of securities on hand will in time go a long way towards wiping out the profit and loss deficit, which stood in the balance sheet of January 31 at $12,957,413. The par value of these securities is $15,427,259. They are inventoried in the balance sheet at $8,545,745. This is an increase in the year in value of $[illegible],066,463.

The gain, due in a large measure to acquisitions noted elsewhere, is offset by a material decrease in accounts receivable and in the profit and loss deficit.

Certain of these securities were sold during the year at a profit of $136,955. Among the policies which are outlined in this report is the application of the surplus to the purchase of the company's bonds. In the year, $750,000 of them were purchased and canceled. All purchases of material, etc., were made for cash, and the company has no floating indebtedness. Its only liability of any importance, against which securities are not outstanding, is the sum of $402,264, accounts payable. After the date of the report, and on February 26, a $200,000 mortgage on the Edison Building, New York, was paid off out of the surplus.

It was found that the $2,000,000 set aside in January to provide for a shrinkage in assets, has been sufficient for that purpose. The company acquired during the year new securities to the amount of $5,274,950 par value. This sum is included in the $15,427,259 valuation cited preceding.

The weak point in the report is the comparatively large sum still carried as accounts receivable. This is $4,578,600 against a total revenue of $12,820,395. To be sure, this is a decrease of over $2,000,000, as compared with last year—see balance sheet—but it strikes some as being rather large for a concern that is doing a "cash business". BAIN.

New York, May 1.

Mr. I. J. Kusel has disposed of his interests in the Missouri Telephone Manufacturing Company, of St. Louis, and resigned from the office of president. Mr. J. D. Perry Lewis, formerly secretary and treasurer of the company, has been elected president.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED APRIL 27, 1897.

581,263 Electrical connection; H. P. Brown, New York, N. Y.—Consists of two meeting or jointed conductors of a permanently plastic alloy, electrically connecting the two.

581,281 Underground trolley conduit; J. D. Griffen, New York, N. Y.

581,283 Secondary battery; V.M. Harris, Chicago, Ill.—A storage battery comprising a central metallic positive element, a porous cup surrounding the same, a mass of active material within the cup and about the element, an outer copper-gauze, mercury covered negative element, a case or cup to contain the whole, and a suitable fluid within the same.

581,298 Registering mechanism; W H. McFall, Philadelphia, Pa.—Consists of a register or counter, of a rotating cam engaging with the gearing of the counter to actuate the same, and a motor for rotating said cam.

581,327 Electric gas-lighter; L. L. Borradaile, Philadelphia, Pa.

581,340 Magneto-electric machine; E. R. Cutten, Atlantic Highlands, N. J.—Consists of a normal armature circuit and driving mechanism for the armature, including a gear-wheel, of a spring contact device adapted to engage the teeth of the gear-wheel during rotation thereof, and a shunt circuit for the armature current, including said wheel and spring contact device.

581,350 Telephone instrument; J. E. Keelyn, Chicago, Ill.

NATIONAL ELECTRIC LIGHT ASSOCIATION.

NEXT CONVENTION AT NIAGARA FALLS, JUNE 8–10.

TO THE EDITOR OF ELECTRICAL REVIEW:

Arrangements have been made with the management of the International Hotel and Cataract House to accommodate members and guests attending our Twentieth Convention, to be held at Niagara Falls, June 8, 9, 10. Rates will be from $3 to $5 per day, American plan.

As the time approaches for holding our Twentieth Convention, unusual interest and activity is displayed by our members. The inquiries for hotel accommodations are very large, both from active and associate members and the trade in general, one company alone having reserved 25 rooms, another 14, and so on. Notwithstanding the heavy requisition for accommodations, we feel that ample provision has been made for all, as we shall practically have the resources of both the International Hotel and Cataract House at the disposal of our delegates and guests. It is well, however, to engage rooms early to insure choice locations. This can be done by addressing the hotels direct, or the secretary at the headquarters of the association, 136 Liberty street, New York city.

The papers to be read and topics discussed are of the utmost importance to all our members, and the programme of entertainment embraces all points of interest in and about the Falls, which, since the introduction of electricity on so large a scale, are of unusual interest.

Copies of papers and programme of proceedings and entertainment will be issued in a few days.

Respectfully,

GEO. F. PORTER,
New York, May 1. Secretary.

FOR SALE.

Complete Set of X-Ray Apparatus, including

10-inch Ritchie Coil,
¾-Horse-power C.-W. 110-Volt Motor,
Rotary Brake (6 brakes),
Three 3-m. f. Marshall Condensers,
Carpenter Rheostat,
5x7 Fluoroscope.

This set for sale, complete or in parts, cheap. Address

H. D. HAWKS, Tarrytown, N. Y.

DYER & DRISCOLL,
PATENT SOLICITORS,
36 WALL STREET, N. Y.,

Have done all my patent soliciting work, both for this and foreign countries, continuously for the past fourteen years.

Thomas A. Edison

PATENTS.

TRADE MARKS. DESIGNS. COPYRIGHTS.

CAN YOU OBTAIN A PATENT?

Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.

All patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.

REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

EDW. S. DUVALL, Loan and Trust Bldg.,
Solicitor of Patents, WASHINGTON, D. C.

Wanted—An Idea Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write JOHN WEDDERBURN & CO., Patent Attorneys, Washington, D. C., for their $1,800 prize offer and list of two hundred inventions wanted.

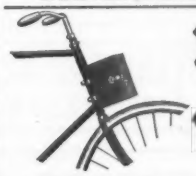
"Dixie." The Southern Industrial Journal, tells the truth about Southern conditions and possibilities. If you are interested, send 25 cents for 3 months or $1 per year. THE "DIXIE" CO., Atlanta, Ga.

GORDON PRIMARY CELL

The increasing popularity of the Gordon Primary Cell among the Fire Alarm and Police Signal Service of the leading cities, the railroad, telegraph and telephone companies, and the general adoption of our steel enameled cell for gas-engine, launch and marine service attest most highly to its merit, efficiency, adaptability and economic features.

If you wish to read the testimonials in its behalf, and learn its full description, kindly apply for circular and price list, to

GORDON-BURNHAM BATTERY CO.,
82 to 86 WEST BROADWAY, NEW YORK CITY.



Bicycle Kodaks

NOTHING SO FITS INTO THE PLEASURES OF BICYCLING AS PHOTOGRAPHY.

Pocket Kodaks, Cartridge Kodaks. Bullets and Bulls-Eyes,
$5.00 to $25.00.

Especially adapted to the wheelman's use. They use our light-proof Film Cartridges and can be

LOADED IN DAYLIGHT.

"Bicycle Kodaks" booklet free at agencies or by mail.

$2,853.00 in Prizes for Kodak Pictures. $1,475.00 in Gold. *Send for "Prize Contest" Circular.*

EASTMAN KODAK CO.
Rochester, N. Y.